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Use of Polarizing Microscope in Factory Control

By W. R. LESTER[1]

A GREAT many papers have been written on the use of the polarizing microscope as an aid to the glass technologist in the study of stones, devitrification and the rapid identification of batch materials, but information on its use as an instrument for the control of the quality of bottle glass is lacking.

In its simplest form the polarizing microscope is optically the same as the ordinary glass factory polariscope, the greatest difference being found in the manner of polarizing the light, which in the polariscope is accomplished by the means of a black glass plate set at the polarizing angle and in the microscope by the use of a small nicol prism.

The polariscope is a useful factory instrument when intelligently used, but in some cases it does not tell the most important part of the story, that is, the manner in which the residual strain is distributed in the ware. It will be shown later that it is possible for the ware to be commercially perfect as determined by the polariscope, but a microscopic examination of a section cut from the ware will show the presence of strain arranged in such a way as to cause considerable breakage from even mild thermal shocks.

Cords also may be detected with the polariscope as "Strain Lines," but the accurate interpretation of their intensity and arrangement is impossible except by the means of a polarizing microscope.

The microscope used in the study of cords and strain is equipped with a 32 m. m. objective; a 7.5 power eye-piece, and a sensitive tint plate (red of the first order). The microscope must be equipped with a revolving stage. The glass sections are cut by means of a Crystolon grain (Bakelite or shellac bond) cutting wheel running at a speed of about 600 r.p.m. The section is then ground on a grinding plate (speed about 200 r.p.m.) using Crystolon grain (grain sizes No. 90, 120, 200). The cutting wheel and grinding plate may be built as a single unit.

A ring section about 0.5" in height is cut from the ware to be examined and immersed in a liquid whose refractive index is nearly the same as that of the glass. Monochlorbenzine makes a suitable liquid and its index may be lowered by the addition of carbon disulphide.

[1]Maryland Glass Corporation.

The immersion liquid is contained in a crystallizing dish of sufficient capacity,—the bottom of which must be free of strain.

Place the dish on the stage of the microscope and focus on the upper surface of the section. With the nicols in the crossed position and the tint plate removed the field is dark or else consists of grey bands. In either case rotate the stage and note whether there is any change in the field. If strain is absent the field will remain dark, but if strain is present the field will become alternately light and dark. In the case of strain being present turn the stage until the field shows its maximum brightness noting the angle the section makes with the nicols. On inserting the tint plate the field becomes colored. With the analyzer and tint plate removed cords will show up as dark lines in the section. It may be necessary in the case of fine cords to partially close the substage diaphragm before the cords become visible.

The ring section must be examined all over its surface by means of the above three ways and in the first two the section must always be kept at the angle of maximum brightness.

Ring sections of perfectly annealed homogeneous ware will appear under the microscope, with the tint plate inserted, a uniform pink and with the tint plate removed they will show a uniform dark field just as if no object were present. Commercially it is impossible to perfectly anneal ware as the temperature gradient (which determines the amount of stress left in the glass after annealing) cannot be entirely eliminated during annealing. Well annealed ware or ware with a low temperature gradient during annealing will normally appear banded into usually three zones. With the tint plate inserted the outer zone or zone at the outer face of the glass will appear blue or orange, the zone at the inner face will appear orange or blue, or the reverse of the outer zone. The center zone will appear pink. In terms of stress the outer zone is in compression and the inner zone is in tension. This type of stress is due to the difference in cooling rates of the inside and outside surfaces of the ware and is general in the case of narrow neck ware. In wide mouth ware the zoning will not be the same as a different type of gradient is set up in the glass walls.

If during the annealing period the original temperature

gradient existing during the blowing of the ware is not entirely removed the ware on cooling to room temperature may be in tension in the outside zone, due to the inner surface of the ware being colder than the outside surface. As glass will break easier under tension than under compression and the temperature gradients (which cause temporary stress) set up in the ware during hot filling or a hot to cold test are of the type that will cause tension to be set up in the outside zone of the ware it is easily seen that ware originally

FIG. 1. VERY FINE CORDS. ORDINARY LIGHT

having tension in this zone will readily break under the influence of small temperature differences.

Compression then is the ideal type of stress to be present in this outside area for ware that has to undergo severe temperature differences. With well designed lehr and intelligent control it is seldom that tension will appear in the outside zone, slight compression usually being the stress present.

A much more serious cause of tension is the general rule and is the stress caused by cords enclosed in the mass of glass. Cordy glass is encountered in almost every glass factory at one time or another, and is usually the cause of the majority of breakage rather than breakage from faulty annealing.

Cords are streaks of glass differing in composition from the main body of glass and have, therefore, correspondingly different coefficients of expansion. If a cord is lower in expansion than the surrounding glass it tends to contract slower and is thereby compressed by the surrounding glass with the result that it reaches room temperature in a state of strain. A cord of higher expansibility will also be strained as it tends to contract faster than the main body of glass, but is prevented from doing so by the adjacent layers of glass.

Sections of cordy glass when examined by means of the microscope will show a great many areas of intense strain and it is the extent and position of this strain that determines the resistance of the ware to mechanical and thermal shock. (Fig. 2.)

It is not possible to draw up a set of rules on what would be the permissible amount of strain and cords in the glass to keep breakage at the minimum,—the only thing that can be done is to use the microscope along with mechanical and thermal shock tests. Whenever ware sections look bad or doubtful the ware must be tested by the means of progressive shock tests, and if it stands a temperature gradient equal or greater than it will meet in practice the ware is fit for use.

If any trouble is experienced in the determination of stress by the use of the tint plate the following experiment may be tried. Focus on the upper edge of a perfectly annealed glass slide. With the nicols crossed and the tint plate in position, press gently on one side of the slide. The side that is

FIG. 2. VERY CORDY GLASS. NICOLS CROSSED

pressed will be in compression and will appear when viewed at the angle of greatest intensity either blue or orange. The opposite side being in tension will be then either orange or blue. In practice, it is best to adopt a standard position for the glass sample, such as a direction of northwest to southeast. All other samples are then inspected in this manner.

Colloids in Glass

Volume III of "Colloid Chemistry, Theoretical and Applied" by Jerome Alexander, is just off the press. It contains chapters on the theory and application of material in the finely divided colloidal state.

The Chapter on Glass has been written by Dr. Alexander Silverman of the University of Pittsburgh, and deals with the presence of colloids in colored and opalescent glasses, mirror films, and so forth. A bibliography of the applications of colloid chemistry to glass is provided.

Durability and Protection of Silvered Glasses

By JACQUES WOLF [1]

Formerly Managing Director Mirror Factories, Belgium

MOST of the defects in mirrors have their source in an insufficient or unsuitable protection of the metallic silver. Hence, the principal condition for a resistant and durable silvered mirror is a faultless backing.

The purpose of a covering coat on the back of a fresh silvered mirror, is for protection of the silver not only against mechanical influences, but also against the chemical reactions from contact with the atmosphere. Because of these conditions, the requirements for a perfect protection coat are complicated, that is:

1. They must have sufficient mechanical resistance to protect the mirror from scratches, shocks, etc.
2. The coat must absolutely isolate the silver from the influence of the weather.
3. The covering coat must itself have a sufficient chemical resistance against atmospheric attack and normal physical circumstances.
4. The materials forming the protecting coat must be without any chemical effect on the silver precipitate forming the metallic coat of the mirror.

Because of these requirements selection of a suitable backing material is difficult, as it is almost impossible to produce a varnish which will fulfill all the conditions. Generally two or three of them can be completely fulfilled but the others either are neglected or necessarily left unconsidered. The cause of the difficulties is in the fact that the substances employed in industrial practice for making varnish for mirror protecting purposes are by their nature injurious to and damage the silver if special precautions are not taken.

The protection coats worth considering for mirror finishing may be divided into two classes: (a) Varnish coats and (b) Protecting coats. The former are ordinarily employed in mirror fabrication as protecting and covering coats, while the latter serve rather as a special strengthening of the varnish coat in order to give it a higher resistance against atmospheric influences.

(a) THE VARNISH COATS

The protection and the covering of a freshly made silvered mirror is executed in two phases. The thin silver coat is not strong enough to resist the pressure on the friction of the brush with the somewhat viscous varnish. Frequently also the covering coat is porous so that the silvering would be directly exposed to the effects of the atmosphere where these pores occur. Moreover, the varnish often contains substances which immediately attack the silver coat causing spots and other phenomena classed as defects in the mirror. For that reason it is necessary to make the varnish coat by the superposition of two coats, that is:

1. The protecting coat.

This is a shellac coat made by dissolving shellac in alcohol. A good recipe is: 40 lbs. finest orange shellac in 100 liters pure industrial alcohol of 96%.

The coat is to be spread with the utmost care. The silver must be completely dry before venturing to put on the shellac, otherwise the humidity which is the principal cause of the appearance of spots on the silvering, would be maintained. If the silvering is not dry the dampness remains in the protecting coat, and, moreover, an insufficient drying of the silver conceals a second danger in itself. When these coats are not quite dry before the covering with the varnish, a part of the varnish solution, (i.e., alcohol) remains contained in the coat, which thus becomes hygroscopic. Consequently instead of the moisture being expelled it is attracted through the pores of the covering coat. On that subject it is to be noted, that shellac, although one of the oldest and most used varnishes for silvering purposes, is in itself of doubtful value. Rosins as shellac is generally very easily attacked by alkaline ammoniacal mixtures. The resultant decomposition causes a development of organic acids with immediate damage to the silvering. Moreover, the shellac varnish is not always made of genuine shellac and alcohol, but often contains impurities which have their origin either in the alcohol or in an unsuitable quality of shellac. All these factors are capable of causing defects in the silvering.

The shellac coat, though necessary, even in faultless hands is a factor of weakness. Consequently the essential part of the resistance of the varnish coat of the mirror, is in the composition and properties of the external covering coat.

2. The covering coat.

The covering lac is almost always a mixture of heavy consistency such as gum damar dissolved in benzol, with some coloring stuffs, lead or chrome oxide, or a mixture of asphalt, chalk and turpentine oil. These varnishes frequently contain numerous sulphides or organic acids as impurities, which have a bad effect on the silvering. Even if the shellac coat is entirely blameless, both in composition and application, these dangerous impurities in the protecting lac will soon permeate the protecting coat, reach the silver and cause defects to appear.

The following is a good and durable covering lac:

25 liter benzol
15 lbs. damar gum
4 lbs. zinc oxide
6 lbs. yellow ochre
10 lbs. asphalt
10 lbs. red lead.

[1] Editor's Note: As the temperature of the bath rises, its conductivity also rises, hence with the same E.M.F. the current density will increase. Similarly a lower concentration of solution or of acidity or too great a distance between the anodes and the mirror result in a decrease in the conductivity of the bath and so require a higher E.M.F. to maintain the proper current density. Too high a current density results in a dark colored or "burnt" surface. With an E.M.F. of 0.5 to 1.5 volts a current density of 0.06 to 0.1 amperes per sq. in. of mirror surface generally gives good results. When plating small articles such as microscope or dental mirrors care needs to be taken that the same number of mirrors are kept in the bath at one time. That is a dozen of more mirrors can be kept in the bath and replaced in rotation at stated time intervals. They should not be exposed one at a time to the full anode surface. Often a copper sulphate solution higher than 10% concentration is used, with 4 to 8 ounces of sulphuric acid added per gallon of the solution.—D.E.S.

Though the best lacs are made of damar gum, these again are not absolutely resistant and may be easily attacked by the atmosphere, thus causing the development of the dangerous organic acids. Moreover, in industrial practice, for reasons of economy, the composition of the cover varnish is frequently modified. By modification it is possible to obtain a more fluid lac, which dries rapidly. This permits quicker finishing and a higher mirror output, but the capacity of resistance is considerably diminished. Consequently, spots result in the silvering, or the covering coat shows defects, that is, it does not stick but splits and cracks under the slightest shock during manipulation. The elasticity is also unfavorably influenced and the coat may be torn by subsequent fluctuations of temperature. The covering varnishes have a very small absorption or capacity of resistance against ultraviolet rays, which immediately attack the components of the coating causing rapid decomposition, while influences of the atmosphere and the noxious substances of the decomposed varnish act directly on the silver coat.

When it is known that the mirror will be exposed to very unfavorable atmospheric influences, such as in the tropics or in bathrooms, the covering coat may be covered with a special aluminum lac, made of aluminum powder and shellac.

(b) THE PROTECTING COVERS

Because the protecting value of the covering coat is diminished by various influences, the main factor controlling durability of the mirror is the constitution of the protecting coat. And because the shellac varnish is a source of weakness, the silver is sometimes protected by a metallic covering, generally when the mirrors are to be exposed to strong physical and atmospheric influences, or when they are to be used for special purposes. In such cases a copper coat may be put on the silvering by electroplating. Such a copper coat isolates the silver completely from the atmosphere and the substances in the varnish of the covering coat.

1. Copper plating.

Electroplating a silvered mirror is done in a slightly acid bath saturated with copper sulphate. The mirror is slowly dipped or pushed into the bath, according to whether the workng manner is vertical or horizontal, and with the silvered side turned towards the anode.

For the practical execution of the job, two important factors must be considered, that is, the electrical stream and the bath. On these depend the character of the copper coat, in addition to the capacity of resistance and the quality of the protecting coat. The action of the various factors can be summarized as follows:

The strength of the current, expressed in amperes, determines the quantity of metal that is deposited on the mirror during a definite time. Generally it is reckoned that the deposit of copper per ampere is about 0.019 grams in one minute.

The density of the current indicates how many amperes are acting on a surface unit, and thus points out the quality and the character of the copper covering. There are limits in the range of current density. With too high a density, for instance over 7 amperes, the metal parting takes place too intensively and does not form a connected homogeneous, resistant, strongly-adhering copper cover, but in its stead a powdery metal coat. A good covering is obtained at a density of 0.3 to 0.5 amperes for about 15 square inches. Although it is possible to obtain a firmly adhering metal coat with a higher current strength, nevertheless, such a coat soon has a tendency to granular parting, principally on the edges.

The current tension, measured in volts, depends on the concentration and the composition of the bath, and for that reason it should be measured as a check on the bath. The tension does not go above 1.5 volts ordinarily.

(*The bath*) generally is composed of a solution of 10% cupper sulphate with 570 to 1,000 grains concentrated sulphuric acid of 66 gravity.[1] Sometimes some Seignettsalt[2] or ammonia is added.

The bath should be absolutely homogeneous in order to favor a consistent formation of coat and a uniform degree of resistance in the protecting cover over the entire area of the silver. To insure this, it is advisable to renew the bath from time to time. It is also worthy of note that the copper deposit takes place only on the silver. Consequently, to have a good copper cover, it is first necessary that the silver coat in itself be compact and uniform.

The copper plate forming the anode, and the mirror, are always to be kept quite parallel, otherwise there will be a thinner deposit on the part of the silver most remote from the anode. Generally for best results and saving in time the distance between anode and cathode should not be more than 6 to 8 inches. In practice, the mirrors are usually left in the bath about ten minutes, and the plating operation is repeated twice in succession, so that in reality a double plating is obtained. After the plating is finished, the mirrors are simply rinsed with water and covered with the usual covering lac.

2. The capacity of resistance and durability of protected mirrors.

It is to be noted that a first class lacquer protecting and covering coat, well applied, though not completely undamageable, can guarantee an excellent protection for many years and consequently a mirror without defects. But when the mirrors are to be submitted to unusual atmospheric conditions or unfavorable temperatures, it is preferable to substitute a copper covering for the shellac varnish. Nevertheless the metal coat has its limitations, because its durability depends also on the constitution of the covering lac. When the covering coat is porous or after a certain time turns defective, the atmospheric agents permeate to the copper, which is also attacked and finally destroyed. Under normal circumstances an electroplated silvered mirror will last for many years without being damaged. By reason of unfavorable fluctuations of temperature it may happen that the covering lac on the copper coat shows splits caused by the differing expansion coefficient of the metal and varnish coat.

A thin sheet of glass makes a good overcover for a mirror for special uses as it increases the resistance to the atmosphere considerably. For the tropics, the covering coat may be covered over with paper tarred on one side which thus provides additional protection of the covering lac.

[2] Potassium sodium tartrate.—D.E.S.

The Manufacture of Rolled Plate

By ERNST LUTZ*

(*Continued from the January, 1932, issue*)

This work has been revised, so far as the English and the technical expressions are concerned, by F. W. Preston, who has also added a number of notes relating in general to the special conditions of American practice; but it must be understood that the opinions expressed in the text are those of Mr. Lutz, and neither the Editor nor Dr. Preston accepts responsibility for them.

WHERE straight grinding and polishing tracks with rectangular tables are installed, a part of the line must be left free before the first grinder head; this allows a sufficient period of time for the setting of the sheets and the hardening of the plaster before a freshly set table arrives under the first grinding machine; in the same way, at the finishing end, a space must be left beyond the last polishing machine to permit enough time for the cleansing and stripping of the sheets. (Figs. 135 C and 135 E.)

The laying can be done much more quickly on a line that is to carry sheets of uniform dimensions (e.g., one sheet exactly covering one table) than it can be done on a line of tables where sheets of all sizes are to be worked and the sheets are laid over the joints of the tables. In the first case, each table is set by itself and then joins the line, while in the second case the empty tables must have joined the line before they are set; they are thus subject to the pressure that keeps the line in motion, in order that the butting edges of the tables do not separate and the tables do not move against each other in any way.

The higher the speed of the tables, the more extensive must be the free ends of the line for the setting and stripping. The length of the free end of the line before the first grinding machine must be at least ¾ of the traveling speed per hour, because the setting of the sheets including an allowance for possible disturbance requires at least 10 to 15 minutes and the plaster needs 20 to 30 minutes to harden sufficiently. The extent of the free end necessary for the stripping corresponds to about ¼ to ⅓ of the traveling speed per hour.

Naturally, the useful part of the surface of a rectangular table is larger than that of a circular table. Not only can tables intended to carry sheets of uniform dimensions be utilized to full advantage, but tables carrying sheets of various sizes can be utilized to an average of 98% of their nominal areas. To achieve this, the width of the rough glass sheets coming out of the lehr must correspond approximately with the width of the tables, after the usual strips at the edges of the sheets have been cut away. If there occurs much breakage in the lehrs and much waste in the cutting shop, the above percentage is lowered considerably due to the great number of small pieces resulting from these earlier processes.

The clamp illustrated in Figs. 168-170, for which German Patents No. 255,829 and 269,168 of July 12, 1911, were granted to Barot and the St. Gobain Co., opens and closes automatically, so that no manual operation is required, except that when the clamp is lowered it must be aided with a rod in case the guides 8 with the rubber rolls 9 should not move properly over the sheet edge. The clamp is suspended in the hook of the wedge piece t, which can move up and down between the two shanks b and c. In opening and closing the clamp the rollers, s and s^1, and the upper ends of the shanks move on the working surface of

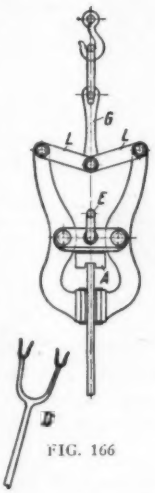

FIG. 166

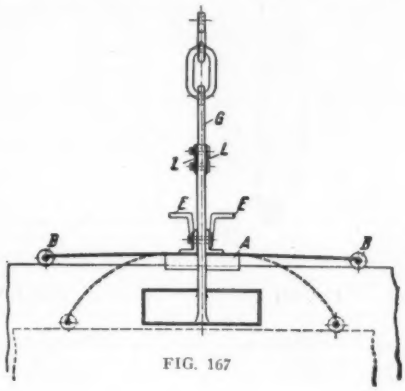

FIG. 167

the wedge piece t, causing the grippers at the lower ends of the shanks to move towards or away from each other. The wedge piece t is guided at the same time by the two straps

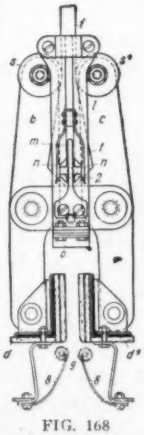

FIG. 168

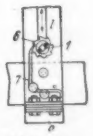

FIG. 170

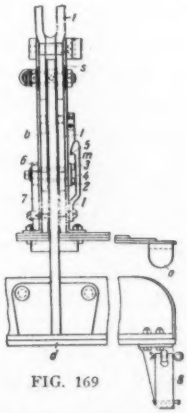

FIG. 169

l so that it cannot escape. The working faces of the wedge piece are so formed that until the sheet is gripped, the grip-

*Of Desseau, Germany. This work is appearing in German in the new edition of *Dralle-Keppeler*, "Die Glasfabrikation."

FOOTNOTE: In the Figures, originally prepared for use eventually in the new edition in the German language of *Dralle-Keppeler*, "Die Glasfabrikation" in 1931, dimensions are given in metres (*m*) and millimetres (*mm*). We would like to have given these in feet and inches but the translation and the making of nearly two hundred and fifty new illustrations would have involved a prohibitive loss of time and expense. To some of our readers the metric system is as familiar as the English units; for the others we may say that a metre is approximately 40 inches, and a millimetre is approximately 1/25 of an inch. A thousand millimetres, of course, go to a metre.—F. W. P.

pers move very slowly, but then quickly embrace the sheet with increasing pressure. With the clamp open the clamp body, relative to the wedge piece, is pushed to its highest position as shown in Fig. 168. In this position it is held by a catch m, the nose 5 of which rests on a cam of the click-wheel 2, keyed on to the bolt 1 which is journalled in the wedge piece t. In this position of the click-wheel 2 the body of the clamp is so coupled to the wedge piece t, that it cannot descend. Now the octagonal click-wheel 2 has four

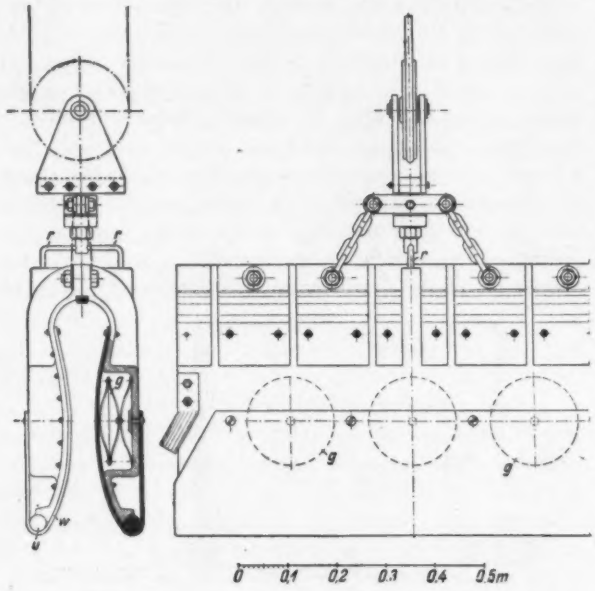

FIG. 171 FIG. 172

of these cams and also four feathers 4; notches and feathers alternate, so that, i.e., if the click-wheel 2 makes ⅛ of the full turn the clicker nose 5 meets a notch and the body of the clamp can then move downwards along the wedge piece t. The bolt 1 journalled in the wedge piece, at its end opposite to the click-wheel 2 carries a ratchet wheel 6 provided with 8 teeth and of pitch equal to that of the click-wheel 2; on the same side as this ratchet wheel 6 and on the frame of the tong there is also a clicker 7. Now if the open clamp, the shanks of which relative to the wedge piece are in their highest position, with the clicker 5 resting on a notch 3 of the click-wheel 2, is lowered on the upper edge of a glass sheet until the frame of the tong with its elastic bridle o rests on it, then the wedge piece will still move down a certain distance. Thereon the ratchet wheel 6 will hit the clicker 7 and be moved ahead one tooth, causing the click-wheel also to move ⅛ of a turn. If now the rope, and with it the wedge piece, is raised again, the clicker 5 will pass through two of the grooves 4 forcing the clamp to close and lift the sheet. When the sheet is set down, the bridle o still rests on its edge while the wedge piece is further lowered until the ratchet wheel 6 again hits the clicker 7 and again turns the click-wheel 3 by one-eighth of a turn; a notch 3 will again come beneath the clicker 5 so that when the wedge piece is raised, the clamp is caught and thus lifted in its open position, leaving the sheet free. In the course of removing a number of sheets, this cycle is repeated indefinitely, i.e, the clamp is entirely automatic and moves fully automatically. When lowered for gripping, the clamp is open, while when set on the sheet and raised again it closes itself; when the sheet is set down the tong opens and disengages from the sheet and remains open when lifted anew. The two springs n hold the octagonal click-wheel 2 at its momentary position, so that it can only be turned by the force of the impact of a tooth of the switching wheel 6 against the clicker 7.

This clamp has proved very successful; it is easy to operate, and grips safely. However, the switching components 6 and 7 and the springs n have to be carefully watched, as the whole mechanism will fail if these do not engage accurately, or if the springs get weak. The clamp is manufactured in three sizes; the size I for heavy rough glass sheets has an overall length from the uppermost point of the eye i down to the under edge of the grippers of 29⅛″; size III which is intended for polished sheets only, has an overall length of 21⅝″, and the intermediate type size II which may be used for either purpose, is 24½″ long. The distance between the turning points of the two shanks is 6″, 5″ and 4⅜″; the cross section of the shanks immediately above the grippers is 2½ x ¾, 2⅛ x ⅝, $1\frac{1}{16}$ x $\frac{9}{16}$ square inches and the diameter of the rollers s, s^1 is 3⅛″, $2\frac{9}{16}$ and 2⅜.

Fundamentally different both in design and operation is the clamp of Robail shown in Figs. 171 and 172; U. S. A. Patent Specification 1,049,150 of the St. Gobain Co. In this case the sheets are not held by their own weight and that of the tong but independently thereof by the force of symmetrically arranged springs g. Clamps intended for the handling of rough glass sheets have three pairs of these springs while clamps employed for polished sheets have only two. These springs sit in a cast-iron or cast-steel box in which they are kept airtight by leather walls w. Left to themselves the springs press the two leather walls tightly against each other; in order to open the tong the spring-chamber is put in communication with an evacuated tank operated by an automatic vacuum pump. The atmospheric pressure will then press the springs together, so that the clamp can be pushed over the edge of the glass sheet. For the closing of the clamp the spring chamber is opened to atmosphere by means of a threeway cock; this is done slowly so that the boxes fill up gradually and slowly with air and the springs do not hit the glass. The solid rubber rods u act as buffers for the clamp when lowered and at the same time serve to seal the leather walls. These latter are faced with rough cloth, rubbered linen, paper cloth, or roughened rubber giving a high friction against glass.

Air is admitted and withdrawn through a rubber tube and the gas tubes r; the threeway cock is either operated by a rod from the floor or directly from the crane-driver's stand. The vacuum receiver and the suction pump are placed immediately on the trolley or alternatively on the crane bridge; in the latter case the air tube, running over the trolley, winds itself automatically on a drum. Clamps of this design have also proved very successful and their operation is even easier than that of those mentioned before; the air suction arrangement, however, means compli-

cation and increased costs for the crane; further the special springs must be inspected frequently, as the gripping action of the clamp depends solely on them. The length of such a clamp fitted with three pairs of springs is 53″; the one with 2 pairs of springs is correspondingly shorter.

For the sake of completeness a few other devices for the suspension and the conveying of large sheets may be briefly gone into; they are mainly used in combination with overhead rails. In an arrangement as shown in Figs. 174 and 175 a small trolley of 12-20″ wheel centers runs on two

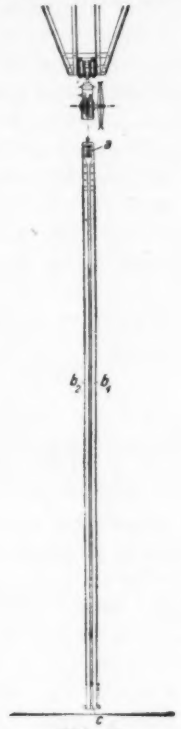

FIG. 174

C-form rails; to the trolley itself is fixed a hand winch of 1,300-1,700 lb. capacity, on the rope or chain-ends of which a 120-140″ long double-T-girder a is fixed and can move up and down. On to this girder a the glass sheet is suspensed with the aid of double boards b_1 and b_2, which have hooks at their upper end for fixing on to the girder a; at their lower ends the boards b_1 are provided with a shoulder c, on which the glass sheet rests when the girder a is lifted. The other board b_2 at its lower end is tied with a bolt so that the sheet is caught in between the two boards, which themselves cannot deviate from their position. First, the glass sheet stands on two wooden blocks d lined with felt; the girder a is now lowered by the winch until it is caught by the iron hooks of the board b_1 and at the same time the shoulder c comes to lie underneath the sheet. After the boards b_1 in this way have been put on the sheet, the counter boards b_2 are also hooked on to the girder and at their lower end tied up with b_1. When the girder a is now wound up the sheet will hang free; the girder is lifted until it comes in contact with the under side of the winch, which itself is operated by a rope e. In pressing against the sheet and operating with the trolley, care has to be taken that the lower back edge of the sheet is not too strongly pushed downwards, as otherwise it may hit the floor; in the same way the diagonally opposite edge of the girder a must not be pressed too much upwards, so as to hit the overhead rails. The lift of the girder a is about 8″, so that with a height of the wooden blocks d of about 3″, the lower edge of the sheet during its transport will be 11″ above the floor. Providing that sufficient care is taken, this should be ample to avoid any danger.

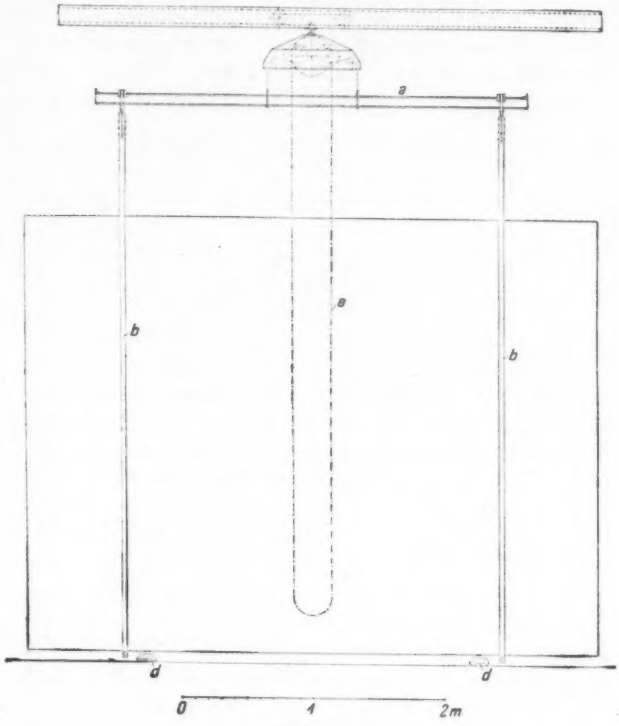

FIG. 175

With a device as shown in Fig. 176 the sheet is held in hemp straps h lined with leather. The worm hoist i for

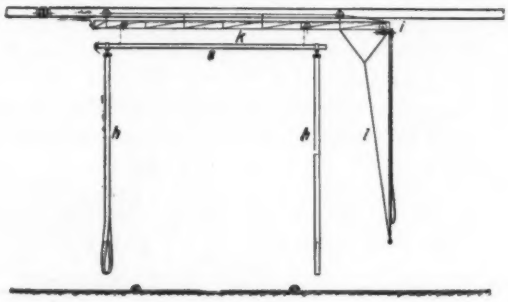

FIG. 176

the lifting and lowering of the girder a is here fitted into the travelling frame k built up of steel sections and gas tubes; this frame carries an arm l which when moving forward can be held in the hand, so that it is not necessary to press against the glass sheet. The distance of the trolley wheels in this case, however, is 13—16′, i.e., it is not possible to move over a turning table into a cross rail or through very narrow curves. It must be borne in mind when design-

ing the building, that the lower edges of the ceiling rails are about 16 to 18′ above the floor. With such a device, sheets of 13½ to 15′ height can be carried; in the ordinary course sheets up to 12′ have to be reckoned with; sheets of a greater height are rare, and those over 13′ quite exceptional. It depends on the general policy, whether the equipment is laid out for the handling of such large sheets or not. Factories whose casting tables are not more than 13′ wide are not in any case in a position to roll such sheets. Instead of the boards b and the strap h, and in combination with the said suspension-rails and hand or electrically-operated winches, clamps also may be used; however, they require somewhat more space for the handling of the sheets.

Wooden frames, as shown in Figs. 177 and 178 were for-

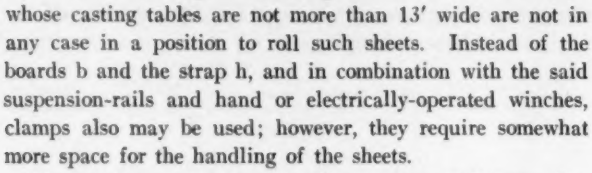

FIG. 177

merly used for the tipping of the sheets; these frames were put up by hand and brought so near the sheet, that it could be caught with the grippers k. Those boards of the frame on which the sheet rests are covered with felt or thick cloth. In place of such portable frames, stationary tables of 11½ to 15′ length and 8—12′ width were employed. The covered deck of these tables was faced with cloth and could be swung by hand around hinges along its long side. Later on, the weight of the table deck and of the sheet on it was balanced by counterweights in a similar way to the rough glass cutting table shown in Figs. 122 and 123; as the table and sheet are turned, the overweight gradually decreases and for this reason the counterweights are made up of a number of components, which, when descending are automatically released in the proportion desired. In the tipping table shown in Figs. 179, 180 and 181 the counterweights g are fixed to the protruding arm of the beam f, so that the balance is always maintained without any alteration of the counterbalance weight g itself. The table swings round the shaft b in bearings c; it is held in its horizontal position by the stationary supports e.

From the tipping table the large sheets are taken up by a suction crane as illustrated in the Figs. 182-189 and put

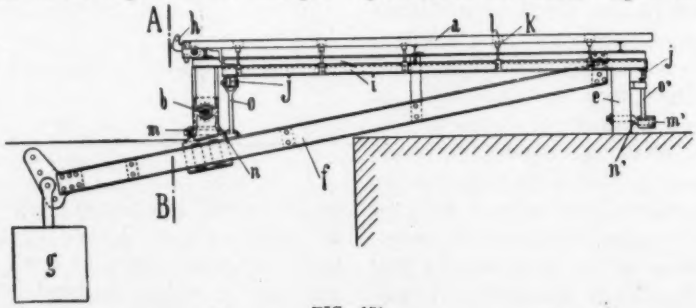

FIG. 179

on the grinding tables. The trolley of these cranes is equipped with a vertically sliding frame a, which carries the suckers b. These suckers, provided with rubber rings c, can be pressed air-tight on the glass surface and are either hollow cylinders containing a piston, which by its upward movement creates a vacuum below it, or alternatively, they are made in a dish-form as shown in the Figures. In this latter case all suckers are connected with rubber tubes to one or more iron tubes on the frame a, which latter again

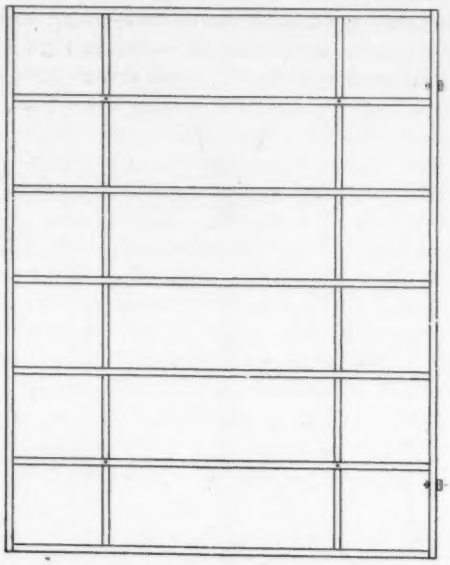

FIG. 178

communicate through rubber tubes with the receiver 15 on the trolley. In this receiver a vacuum is maintained by an automatic air pump. This air pump is either put on the grinding shop floor and connected with the travelling crane through an automatically unwinding rubber tube or, if the crane has to move great distances, the air pump is put on the trolley itself, as shown in Fig. 182 (14). Generally speaking, the suction frame a carries 5 or 6 rows, each consisting of 8 suckers. According to the German Patent Specification No. 290,091 of the St. Gobain Co of June 4, 1912, the suckers are arranged to be slightly movable in the frame, and further the frame itself, which can turn round an axis o—o, is so suspended on to a second frame n—n that the suckers can adapt themselves to all unevennesses and tiltings of the sheets. According to the said specification the rubber rings c are also tapered (Fig. 188) so that they are better able to follow the humps in the glass surface than would be the case with a rectangular or circular cross section. Finally, the specification also suggests

the use of a number of concentric rubber rings (Fig 189); by this measure the pressure is more uniformly distributed over the glass surface f, which, with thin sheets, obviates the danger of crushing, (this danger as a matter of fact is practically non-existent with sucker diameters of 8—10"); for the multiple rubber ring arrangement the further advantage is claimed that the rings can follow the glass surface independently of each other, so that even in case one ring, on account of local humps, does not close tightly, the others will maintain a sufficient contact. In practice, however, one single rubber ring for each sucker has proved amply sufficient and this all the more so, as, according to the same specification, the ports g, through which the air is drawn off, are of such small cross section that even if one sucker or a number of them are not operating properly, the air admitted into the system is not detrimental to the working of the rest of the suckers. The said ports g usually have a bore of $\frac{1}{16}$". The U. S. A. Patent Specification 1,426,930 of Pilkington Brothers in St. Helens, England, proposes to incline the rubber rings to the glass surface,

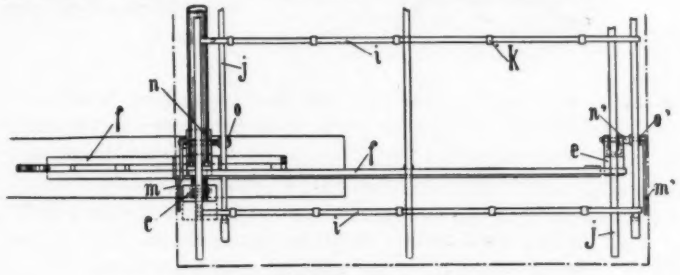

FIG. 180

which, as is claimed, will give a better sealing. The suction frame a is usually about 13¼' long and 10' wide. When operating with smaller sheets the suckers which protrude beyond the edges of the glass surface must be shut off. The spindles h of the suckers are elastically guided in the cylinders i; the elasticity is procured either by spiral springs or by air cushions. The cylinders i again are so guided in the bushing k, fixed to the suction frame, that they can be lifted and lowered by the turning of the eccentric. Each individual sucker can be lifted with the eccentric t and thus be cut out at will. Simultaneously with the lifting the communication with the air tube is automatically cut off; this communication, however, can also be interrupted by a special valve. It is also possible to lift and cut out complete rows of suckers with one single movement. The cutting out and raising is required when working with small sheets, to avoid pressing the surplus suckers into the plaster on the table, and also to avoid interference with adjacent sheets. The German Patent Specification 352,067 of the St. Gobain Co. of September 28, 1919, de-

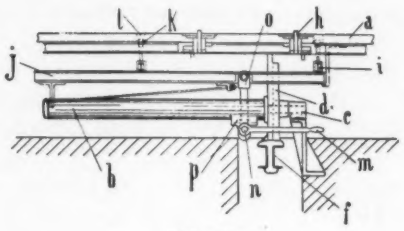

FIG. 181

scribes an arrangement by which the suckers are removably fitted to the frame so that they can be pushed together or spread apart. As mentioned before, relative to the frame n,

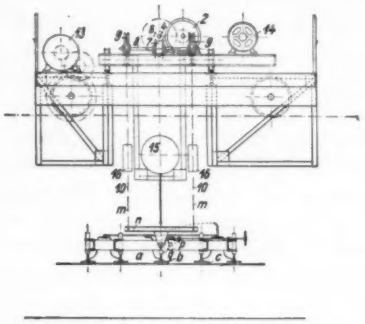

FIG. 182

which is suspended on the crane rods or crane chains, the main frame a can be tilted. This point is very important for the severing of the glass sheet from the grinding table. The sheets stick so tightly in the plaster or on the cloth of the grinding table that it would require a great force for lifting them by a direct pull. They are therefore first freed at one end and only gradually taken up completely. For this purpose frame a is first attached by suction to the sheet and then with the aid of a hand wheel and the gear p, q is somewhat tilted; if now the crane winch lifts the frame there is at first a pull exerted on one of the sheet edges and subsequently the sheet is lifted from this point onwards.* After the sheet is fully freed from the table the tilting of the frame is corrected.

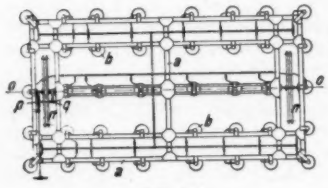

FIG. 184

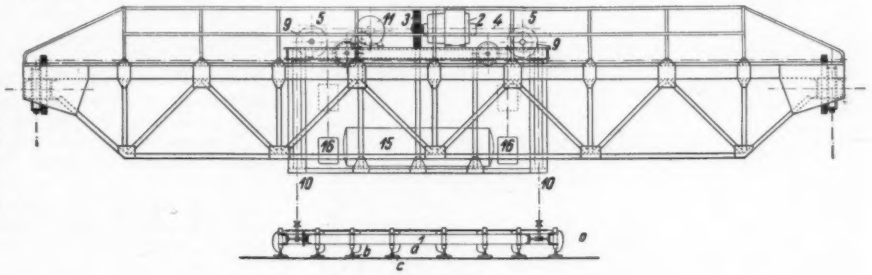

FIG. 183

*It is generally practicable to wedge up a corner slightly and introduce compressed air under the sheet, separating is very effectually from the plaster.—F. W. P.

A 12 HP motor 2 serves for stripping and raising. This motor drives the four chain wheels 9 by means of a gearing 3 and two worm drives 5,5; on the chain wheels run the chains 10 on one end of which the suction frame a and on the other end the four counter weights 16 are suspended. 11 indicates a 3,5 HP motor for the trolley and 13 the 12 HP crane motor. These motors permit; lifting at 15′ per minute, a speed of the crane of 330′ per minute, and of the trolley 100′ per minute. The machines for raising the frame and running the crane are both equipped with an electro-

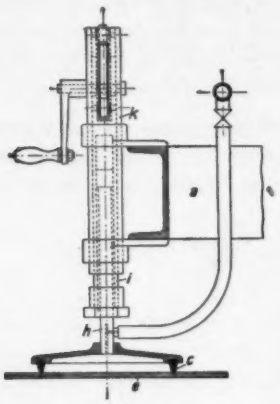

FIG. 185

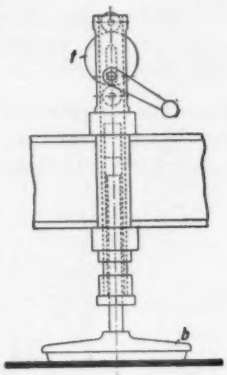

FIG. 186

magnetic brake. All drives are either operated from a driver's stand suspended on the trolley or from the floor by controllers which are put on the suction frame a. For the suction of the air a rotating air pump of 3,500 cu. ft. output and driven by a 7 HP. motor 14 is used; its motor

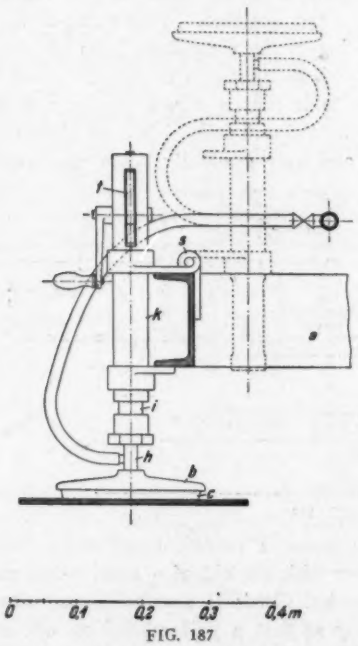

FIG. 187

also supplies the power for a small water-cooling pump. The vacuum tank 15 has a length of about 70″ and a diameter of approx. 28″; the cooling water tank alongside this pump has a capacity of 155 gallons. The air compressor is automatically switched off or on as soon as the vacuum in the receiver rises to about 27″ mercury or falls below 22″.

The introduction of these suction cranes brought great advantages in the handling of the large sheets, for the whole work in the grinding and polishing shop, and particularly for the setting and stripping of sheets from the grinding tables. Not only was labor saved, but also time; the work was accelerated, the danger of breakage appreciably reduced and the danger to the workmen eliminated. Thanks to the now easy operation with the sheets a greater accuracy and care could be demanded of the matchers and of the laying gangs. In the old days the sheets were at first put vertically on the grinding table, then laid down on it by hand and eventually pushed to the desired position. Extra large sheets were first placed on the floor, then a few special

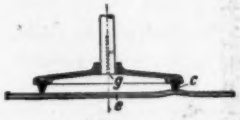

FIG.188

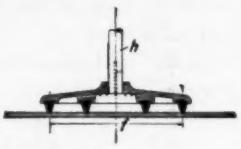

FIG. 189

boards laid against them and the whole tipped over on the table. These boards were of wedge shape, and at their lower end carried a shoulder similar to the one indicated as c of the boards b_1 in Fig. 175. After the tipping these boards had to be withdrawn from underneath the sheet. For the tipping itself and to avoid the hitting of the sheet against the circular edge of the table, a wooden frame first had to be leaned against the table, provided with a tipping edge level with the table surface. To remove the sheets from the table after the polishing, a number of the said wedge-form or piercing boards had to be forced between table and sheet.

(To be continued)

How Exhibitors Meet the Trade Show Problem

Although trade shows appear to be accepted as helpful to business, the opinion of exhibitors in many industries is that methods of conducting these shows must be brought into line with today's changed conditions if buyers of space are to be assured of adequate returns, according to a survey just completed by the Policyholders' Service Bureau of the Metropolitan Life Insurance Company. The results of this survey have been published in a report entitled "How Exhibitors Are Meeting the Trade Show Problem."

The report describes the control methods that have been adopted in the different industries. The information on which the study is based was obtained from 84 trade associations sponsoring national or regional trade shows. Executives interested in the subject may obtain copies of the report by writing to the Bureau at New York.

Distribution of Sales of Lighting Equipment

The Bureau of the Census, Department of Commerce, Washington, D. C., released on November 17 the report I. G. 1207 covering the distribution of sales in 1929 of the manufacturing plants in the lighting equipment industry amounting to $144,966,000 and covering 614 plants. The report gives the value of goods sold to wholesalers, retailers, by manufacturers to their own retail branches, to industrial and other wholesale consumers such as manufacturers, theatres, churches, etc., and to household consumers. Other data are included concerning electric residence fixtures, and motor vehicle lamps. Scores of different commodities are included in the tables summarizing the data, but plants manufacturing incandescent electric bulbs as their primary products are not included.

The Range Finder of Business

The Glass House Cost Accountant

By WM. A. FAWCETT, *Erstwhile Glass House Cost Accountant*

COST accounting shows up the leaks and points the way to profits. It is the keynote of modernism emphasized by the good judgment and constant and careful use of it. Like the range finder on our battleships, it tells us where to shoot with quite a degree of accuracy.

The glasshouse cost accountant is the specialized eye-piece through which the producer sees how the value of his products is reflected in detail all along the lines of production that diverge backwards from the finished goods toward cost of raw material, labor scale, rent of land and buildings, interest on capital, and all the other items which are factors in price.

The cost accountant must be a constant reader of good books and magazines which keep him abreast of modern cost accounting procedure.

Business is like a baseball game, you cannot win the game today on the hits of yesterday.

The cost accountant must see that there be a full and sympathetic understanding between those inside the office and those in the factory.

He should adopt and maintain the principle that the books must be made to fit the business, and not the business to fit the books.

He should be able to visualize the work which he is recording and should have sufficient knowledge of the practical side of factory operations to enable him to detect any errors in the reports. Perhaps above all he needs to have a sympathetic appreciation of the difficulties to be surmounted by the men in the factory to conduct his office in such a manner that it will be a help and inspiration to others of the organization.

He must not allow the idea to prevail that his function is solely that of a watchdog.

The factory men held accountable for reports should be given instructions regarding the preparation of their reports and the part they play in the corporate records. They should have a very clear idea of the purpose served by their reports, what is done with them, and their place in the permanent financial records.

The cost accountant should be sure the factory men have a definite conception of the fundamental differences existing between capital and the use and employment of capital, to the end that maintenance items shall not be charged to construction and vice versa.

On the other hand it is not necessary that the factory men should know anything of the mechanism of the accounting procedure. They need not be informed, for example, how journal entries are prepared, nor is it at all required that they understand the philosophy underlying suspense accounts and income and balance sheet exhibits. There must be co-operation for without it, it is impossible to have records kept with accuracy, which is of the utmost importance. If just one person in the organization who has anything to do with reports or records does not give his full co-operation, the costs will be misleading.

The cost accountant must see that everything is done accurately, for glasshouse accounting necessarily requires that amounts spent for future operation, for construction, shall not be confused with those spent for operation, but that the sharpest line of demarcation shall be maintained between the two.

The close-down period which is the usual customary procedure sometime during the summer months, for permanent improvements, new construction, rebuilding of tanks and general repairs gives the cost accountant a chance to display his ability and requires careful watchfulness on his part of every operation and transaction that takes place.

He is the man who can show up the leaks and point the way to profits.

Cost accounting is a real factor, modern business demands it, progress requires it, notable success is pure luck without it. The glasshouse cost accountant has a large part to play.

What has been written here is by no means the whole story, but it is vital to an understanding of the whole story.

BONNEY

NEW FORMULA FOR THE DRESSING TABLE. SIX GLASS SHELVES WHICH PIVOT ON POLISHED METAL POST. . . . CHAIR OF METAL AND SATIN UPHOLSTERY. . . DESIGNED BY PRINTZ, ONE OF FRANCE'S FOREMOST MODERNISTS

Glass Industry

ESTABLISHED 1920

The First Trade Journal Devoted Primarily to Glass Technology, Engineering, Raw Materials and Glass Factory Equipment and Operation

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Great Gain to the Industry Envisaged from New Concept in the Art of Combusting Fuel

In reviewing the program of the glass division of the American Ceramic Society to be held in Washington, February 8th to 12th, it is noticed that a paper of considerable interest to the glass industry is to be presented by P. Q. Williams and C. Cone of the Surface Combustion Corporation, of Toledo. The title of this paper is "Diffusion Combustion and Its Application to Glass Melting." It is our understanding that this paper will disclose a new concept in the art of combusting fuel and more particularly natural gas.

It departs from the generally accepted methods of burning gas in that no attempt is made to mix the gas with air, either prior to or during combustion. In fact, great care is exercised in avoiding such mixing by burners of very specialized designs. The question might be raised as to how combustion can proceed if the air and gas do not mix. The answer lies in the fact that gases of different gravity and composition have the property when in contact to gradually diffuse into each other, notwithstanding that they might otherwise be in a completely quiescent condition. Taking advantage of these physical laws, the natural gas and air are caused to enter the heating chamber in separate but contacting streams with the result that they diffuse into each other and at the point of contact combustion occurs. This sets up high temperature liberation within the gas stream which causes the gas to crack and liberate large volumes of incandescent carbon. The flame then imparts its heat to the work entirely by radiation.

What this may mean to the glass industry can best be appreciated by those who have for years sought better methods of heat application in the process of melting glass. The plain and level surface of a glass tank offers a very limited area of contact between burning gases and the glass mass, so that efforts to convey the heat liberated by burning gases to this restricted area through "convection" result in low heat absorption. Furthermore, heat imparted by "convection" is only in direct proportion to the difference between the temperatures of the gases and that of the bath. However, when heat is imparted by radiation, the ratio of absorption is increased to the fourth power between the absolute temperature of the radiant body and that of the bath. This means that for a given area of bath such radiant energy as results from "diffusion combustion" greatly increases the effectiveness for heat absorption of the area of the exposed glass surface.

The possibilities thus disclosed would seem to be far-reaching in the improvement that will result from the application of this system of combustion. It is our understanding that a practical demonstration of this system is now under way under production conditions in a plant in Ohio, although it will be some time before definite results can be disclosed to the industry at large.

On to Washington!

GLASS DIVISION PLANS INTERESTING MEETINGS

ALL seven divisions including Glass of the American Ceramic Society will hold simultaneous meetings at the thirty-fourth Annual Meeting of the organization at the Hotel Willard, Washington, D. C., February 8-12, 1932. The National Brick Manufacturers Research Foundation will also gather its members together on Thursday, February 11, to hear reports and papers and discuss subjects of interest.

"On to Washington" will be the aim of many a glass man after he has looked over the rich program provided as below for his entertainment and enlightenment by the Glass Division.

The officers of the Divisions in which our readers are most interested are as follows:

DIVISION OFFICERS

Art, Walter P. Suter, chairman; Myrtle M. French, secretary.

Glass, George W. Morey, chairman; Lois Purdy Turner, secretary.

Materials and Equipment, L. E. Riddle, chairman, F. G. Lord, vice-chairman, V. V. Kelsey, secretary.

Refractories, A. E. R. Westman, chairman; Ray B. Gilmore, vice-chairman; Dorothy A. Texter, secretary.

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L. C. Roche, Maryland Glass Co., Baltimore, Md.
B. T. Sweely, Baltimore Enamel & Novelty Co., Baltimore, Md.
R. H. Turk, Pemco, Baltimore, Md.

GENERAL PROGRAM

Sunday, February 7, 2 p.m., Board of Trustees (Gridiron Room).

Monday, February 8, 10 a.m., Board of Trustees; 2 p.m. meeting of Fellows A.C.S. (Cabinet Room); 6 p.m. Dinner Meeting, Standards Committee on Commercial Standards for Feldspar. CS 23-30, G. W. Wray, Secretary (Fairfax Room). 7 p.m. Dinner Meeting, National Brick Manufacturers Research Foundation.

Tuesday, February 9. 9:30 a.m. Division meetings. 12 M. Dinner Meeting, illustrated address by George Oakley Totten, Jr., President, Washington, D. C. Chapter American Institute of Architects on "Maya Architecture"; 1:30 p.m., trip to U. S. Bureau of Standards; 3 p.m., address by Richard F. Bach, Ceramic Art; Architectural, Home Service and Decorative-Fairfax Room. 3 p.m. A.S.T.M. Committee C-8 on refractories; 4 p.m. Keramos and Beta Pi Kappa meetings, 6 p.m. open Dinner Meeting, Committee on Publications; 8 p.m. General Meeting, Willard Room—1. Address by President Eckardt V. Eskesen; 2. Address: "Industrial Dust Hazards," by Dr. Frederick Wilson; 3, Address "Quality Production," by Richard F. Bach; 4. Address "Washington a Center of Fundamental Ceramic Research," by Dr. John C. Hostetter; 10 p.m. Dance and Frolic, Hall of Nations, Washington Hotel, under auspices of Materials and Equipment Division.

Wednesday, February 10, 9:30 a.m. Division Meetings; 12 m., Reception by President Herbert Hoover, White House Lawn; 12:45 p.m., trip to Mount Vernon with luncheon enroute at Penn-Daw Road House; 6:30 p.m., School Dinners; 9:30 p.m., President Eskesen's reception and dance in Fairfax and Willard Rooms.

Thursday, February 11. 9:30 p.m., Division Meetings; 1:30 p.m., trips to Museums and Government Laboratories; 2p.m. meeting of Fellows in Cabinet Room; 7 p.m., Division Dinners and business Meetings.

Friday, February 12. 9:10 a.m. Leave B. & O. depot for Baltimore.

LOCAL TRIPS BY MOTOR BUS

Tuesday, February 9. Bureau of Standards round trip $0.50 each, leave Willard Hotel 1:30 p.m.

Wednesday, February 10. 12 m., reception by President Hoover, White House South Lawn. Trip to Mount Vernon and Arlington Cemetery, fare $2.00. Buses leave White House South Driveway, immediately after the President's reception. A stop will be made enroute to Mount Vernon for a light and inexpensive lunch. At Mount Vernon the home and tomb of George and Martha Washington will be visited. At Arlington the Memorial Amphitheatre, the Tomb of the Unknown Soldier and the Curtis-Lee Mansion will be seen.

Thursday, February 11. Suggested Trips. Episcopal Cathedral and Franciscan Monastery. Fare, $1.50. Leaving the Willard Hotel at 1:30 p.m. Other trips for parties of 25 or more can be arranged on short notice to the local information desk. Organized trips are available as follows: 1. "Seeing Washington," 2. "Seeing Public Buildings." Most of these sights are convenient to the Hotel Willard. Other suggestions are to visit the following places: 1. The National Capitol and possibly Congress in action, 2. the Congressional Library, best seen at night, 3. The New National and Smithsonian Museums, 4. The Lincoln Memorial, 5. The Pan-American Building, 6. The Washington Monument (good elevator service).

Other points of interest include Bureau of Engraving and Printing, Freer Art Gallery, Corcoran Art Gallery, National Episcopal Cathedral, Soldiers' Home, Franciscan Monastery.

Friday, February 12. Leave Washington B. & O. 9:10 a.m. arrive Baltimore 10 a.m. By bus or switching train direct to Locke Insulator Corporation plant, where porcelain suspension insulators will be demonstrated. 12:30 p.m. bus to Emerson Hotel. Transportation complimentary by Baltimore Ceramic Industries.

At Baltimore, Glass Division,—Carr-Lowrey Glass Company, then to the Maryland Glass Company. Refractory Division: Sparrows Point Steel Plant. Historical Sightseeing Trip.

Glass Division Program

George W. Morey chairman; Lois Purdy Turner, secretary; Donald E. Sharp, Papers and Program.

Tuesday, February 9. 9:30 a.m. Cabinet Room. 1. Diffusion Combustion and Its Application to Glass Melting, by P. Q. Williams and C. Cone, Surface Combustion Co., Toledo, Ohio. 9:55 a.m., 2. Some Observations on a Devitrified Glass: Part I: Thermal Effects, Petrographic and X-ray Studies, Part II: Thermal Expansion, by A. Q. Tool, Herbert Insley, and J. B. Saunders, U. S. Bureau of Standards, Washington, D. C.

Samples of Pyrex glass rod were devitrified at several temperatures between 625° C and 850° C. At the lower temperatures used the rate of devitrification was relatively low, but at 800° C a considerable portion of the glass was more or

less opaque after three days of heating. Somewhat longer treatments caused the whole piece of glass to become filled with crystalline material, and the type of this material depended greatly on the length of the heat treatment. After the shortest treatments producing devitrification the crystalline products were found to be almost wholly cristobalite but with small amounts of quartz and tridymite as shown by petrographic, X-ray, heating curve, and expansivity tests. The inversion point attributed to cristobalite fell in the temperature range from 195 to 220° C. Longer treatments reduced or completely eliminated the critobalite and caused the appearance of tridymite. The inversion points were then found in the ranges 145 to 165° C and 95 to 120° C. The relative magnitude of the inversion effects in these ranges depended upon the length of treatment.

3. The Effect of Boric Oxide on the Devitrification of Soda-Lime-Silica Glasses, by G. W. Morey, Geophysical Laboratory, Washington, D. C.

In previous studies the liquidus temperatures, above which devitrification cannot take place, have been determined for the soda-lime-silica glasses; and the effect of magnesia and alumina on the devitrification of one typical glass has been ascertained. In this study the effect of B_2O_3, in amounts up to 5%, on the liquidus temperatures of soda-lime-silica glasses in general has been studied, with special reference to the commercial glass field. Small additions of boric oxide lower the liquidus temperature in amounts depending on the original glass composition; increased addition usually results in continued lowering, but in some cases the liquidus temperature, after the initial lowering, may rise to a maximum. In addition, an exploratory survey of the quaternary system, Na_2O-CaO-B_2O_3-SiO_2, has led to interesting results.

4, The Relation between Viscosity and Temperature in Liquids and Glass, by F. W. Preston, Standard Mfg. Co., Butler, Pa. 11:10 a.m. 5. The Glass Collection of the University of Pittsburgh, by Alexander Silverman, University of Pittsburgh, Pittsburgh, Pa. 11:55 a.m. 6. Residuals in the Melting of Commercial Glasses, by W. Eitel and W. Weyl, Institut fur Silikatforschung, Berlin, Germany.

By heating alkali silicate under CO_2 at high pressures, alkali carbonates are re-formed to an extent depending upon temperature, pressure, and chemical affinity. The Co_2 thus existing homogeneously dissolved in the glass, and other anions and oxygen similarly dissolved and in chemical equilibrium, are termed "melt residuals" (Schmelzrellkete). Their importance in plaining, coloring, decolorizing, machine-working, vacuum bulb, and electric lamp manufacture, is discussed.

Wednesday Morning, February 10, 9:30 a.m. 7. Constitution of Glass, by E. Berger, Schott & Gen., Jena, Germany. 8. The Annealing of Glass as a Physical Problem, by L. H. Adams, Geophysical Laboratory, Washington, D. C.

The fundamental principles underlying the annealing of glass and the present state of knowledge concerning changes in the internal state of glass are briefly reviewed. Emphasis is placed on the fact that a quantitative explanation of the formation and removal of strain in glass, and an exact determination of the necessary conditions for practical annealing may be obtained on a purely mechanical basis. On the other hand, the state of aggregation of glass is a problem of great interest, and many of the properties of matter in the vitreous state require a consideration of chemical and physico-chemical relationships. In order to have a clear understanding of processes such as the annealing of glass, it is imperative to be able to differentiate the phenomena that involve the internal constitution from those that do not.

10:00 a.m. 9. Annealing as a Means of Producing Desired Refractory Changes in Glass, by A. Q. Tool and L. W. Tilton, U. S. Bureau of Standards, Washington, D. C.

For several types of optical glass the changes in refractivity and in density, per degree centigrade change in the annealing temperature, have been determined throughout the extent of the practical annealing range. These values are fairly constant for a given type of glass and are found to range from -2 to -5×10^{-5} per degree centigrade. These changes in refractivity make it possible for the glass manufacturer to outline a procedure for the production of a series of optical glasses having refractivities which may be standardized and reproduced within narrow limits. The methods used in this investigation, the accuracy of the results, and some special applications in connection with the manufacture of precise optical measuring instruments will be discussed.

10:30 a.m. 10. The Effect of Heat Treatment Upon the Density of Soda-Lime-Silica Glasses, by H. E. Merwin and G. W. Morey, Geophysical Laboratory, Washington, D. C.

The density of a sample of glass, to a limited extent, is dependent on its thermal history, and within certain limits can be altered by the requisite heat treatment. Samples of glass in the ternary system, Na_2O- CaO-SiO_2, of widely varying composition have been held at constant temperatures from 200° to their softening range, and for times ranging from four months to a few minutes. The effect of such heat treatment leads to the following conclusions: (1) Within a limited temperature range, the density is a single-valued function of the temperature, increasing with decreasing temperature; (2) With decreasing temperature an upper limit of density is reached, beyond which the density cannot be increased by longer heatings at the same or lower temperatures. (3) The time required to reach the density corresponding to the desired temperature increases rapidly as the temperature is decreased. (4) Comparison with annealing times of commercial glasses indicates that the density equilibrium is reached in a time much shorter than that required for the removal of mechanical strain.

Discussion until 12:00 Noon.

12:00 M. Reception by President Herbert Hoover, White House.

Thursday Morning, February 11, 9:30 a.m., Cabinet Room, Electric Glass Annealing, by R. M. Cherry, General Electric Company, Schenectady, N. Y. 10:00 a.m. 12. Some New Glasses Containing Bismuth, by E. Raymond Riegel and Donald E. Sharp, (joint contribution from University of Buffalo and Bailey & Sharp Co.)

This paper gives preliminary data on the specific gravities, refractive index, and in some cases, the dispersion and solubilities of some soda-bismuth-silica and potash-bismuth-silica glasses. Bismuth oxide has been incorporated in glass up to a content of 53%. The glasses are brilliant like lead glasses, but do not have unusual optical properties.

10:15 a.m. 13. On the Flow of Glass in Tanks, by F. C. Flint and A. K. Lyle, Hazel-Atlas Glass Co., Washington, Pa. 10:40 a.m. 14. The Form of Cracks in Bottles, by F. W. Preston, Standard Mfg. Co., Butler, Pa.

This paper deals briefly with the stress systems and fracture systems in bottles, or more generally in hollow cylindrical or tubular articles of glass or other brittle materials. The forms the fractures typically take are described and their causes are given.

15. A Note in the Concept of Brittleness, by F. W. Preston.

Attempts have been made to define the brittle state, or at least to explain it, in terms of physico-chemical structures. It is generally assumed, however, that the reader knows just what is meant by brittleness, and the definitions dealing with the mechanical aspect of brittleness are somewhat perfunctory. In this paper the mechanical properties are briefly described. Brittleness is a property of the fracture system rather than of the material, and is not connected directly with the physico-chemical constitution, since certain crystalline and amorphous materials share it, while other crystalline and amorphous materials do not show it.

11:15 a.m. 16. Note on Electrometric Iron Determination, by A. K. Lyle, Hazel-Atlas Glass Co., Washington, Pa. 17. Thermal Expansion, by W. E. S. Turner, University of Sheffield, Sheffield, England.

REFRACTORIES DIVISION

Numerous papers on problems of interest to manufacturers and users of clay products including super-refractories with special emphasis on their firing in a tunnel kiln, strength of silica brick and elevated temperatures, spalling of refractories, etc.

ART DIVISION

During the week a ceramic art exhibit under the auspices of the Art Division will be held at Sears, Roebuck Company, 1105 Connecticut Avenue. C. M. Harder, papers and program.

Tuesday, February 9. 9:30 a.m. session devoted principally to china tableware, etc. Address on "Maya Architecture," illustrated, by George Oakley Totten, Jr. 3 p.m. Fairfax Room. Address: "Ceramic Art, Architectural, Home Service, and Decorative," by Richard F. Bach of Metropolitan Museum of Art, New York.

Wednesday, February 10. Symposium on Ceramic Art Exhibits; Report on Sloane Exhibit. Trends of New York buying public, etc. 12 M. Reception by President Hoover at White House South Lawn.

Thursday, February 11. 9:30 a.m. (Gridiron Room) Meeting devoted largely to glazes.

Friday, February 12. 9:10 a.m. Leave on B. & O. for Baltimore, Maryland.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C., Price 10c each

APPARATUS FOR FORMING SHEET GLASS. U. S. 1,834,942. Dec. 8, 1931. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Co., Toledo, O. Filed 9/27/28.

GLASS FABRICATING MACHINE. U. S. 1,835,172. Dec. 8, 1931. William J. Miller, Swissvale, Pa., assignor to Hazel-Atlas Glass Co., Wheeling, W. Va. Filed 10/16/25.

GLASSWARE FORMING MACHINE. U. S. 1,835,351. Dec. 8, 1931. Leonard D. Soubier, Toledo, O., assignor to Owens-Illinois Glass Co., Toledo, O. Filed 10/20/27.

APPARATUS FOR SPRAYING GLASS, ETC. U. S. 1,835,402. Dec. 8, 1931. John Henry Juers, Passaic, N. J., assignor to Triplex Safety Glass Company of North America, N. Y. Filed 1/21/30.

GLASS FEEDING APPARATUS. U. S. 1,835,553. Dec. 8, 1931. William T. Barker, Jr., Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. Filed 11/2/27.

APPARATUS FOR HANDLING GLASSWARE. U. S. 1,835,579. Dec. 8, 1931. Daniel B. Westin, Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. Filed 6/22/26.

CELLULOSE METHOD OF LAMINATING GLASS. U. S. 1,835,746. Dec. 8, 1931. Louis Bartelstone, Flatbush, N. Y., assignor to Elbee Holding Corp., Wilmington, Del. Filed 6/3/26.

METHOD OF AND APPARATUS FOR MAKING GLASSWARE. U. S. 1,835,758. Dec. 8, 1931. Robert W. Canfield, West Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. Filed 6/8/28.

APPARATUS FOR DISTRIBUTING GLASSWARE. U. S. 1,835,814. Dec. 8, 1931. John E. Schroder, Hartford, Conn. Filed 5/31/28.

METHOD OF AND APPARATUS FOR ANNEALING ARTICLES OF GLASSWARE. U. S. 1,837,311. Dec. 22, 1931. Walter O. Amsler, Toledo, O., assignor to Simplex Engineering Co. Filed 6/3/26.

GLASS WORKING MACHINE. U. S. 1,837,373. Dec. 22, 1931. Victor L. Ronci, Brooklyn, N. Y., assignor to Bell Telephone Laboratories, Inc., New York, N. Y. Filed 8/3/29.

REENFORCED GLASS AND PROCESS OF MAKING THE SAME. U. S. 1,837,455. Dec. 22, 1931. Joseph H. Lewis, Kingsport, Tenn., assignor to Blue Ridge Glass Corp. Filed 9/18/30.

SHEET GLASS CUTTING APPARATUS. U. S. 1,836,365. Dec. 15, 1931. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 8/26/27.

SHEET GLASS APPARATUS. U. S. 1,836,378. Dec. 15, 1931. Luke C. Mambourg Lancaster, O., assignor to Libbey-Owens-Ford Glass Co., Toledo, O. Filed 6/13/27.

SHEET GLASS CUTTING APPARATUS. U. S. 1,836,393. Dec. 15, 1931. Joseph A. Reece, Toledo, O., assignor to Libbey-Owens-Ford Glass Co., Toledo, O. Filed 9/13/26.

PROCESS AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,836,394. Dec. 15, 1931. Joseph A. Reece, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 9/22/27.

GLASSWORKING MACHINE. U. S. 1,840,513. Jan. 12, 1932. Peter P. Kucera, Pittsburgh, Pa., assignor to United States Glass Company. Filed 11/19/24.

LAMINATED GLASS AND APPARATUS FOR PRODUCING THE SAME. U. S. 1,841,689. Jan. 19, 1932. George B. Watkins, Toledo, O., assignor to Libbey-Owens-Ford Glass Co., Toledo, O. Filed 5/28/28.

APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,841,548. Jan. 19, 1932. William E. Nobbe, Toledo, O., assignor to Libbey-Owens-Ford Glass Co., Ohio. Filed 3/11/30.

METHCD OF AND APPARATUS FOR ANNEALING GLASSWARE. U. S. 1,840,463. Jan. 12, 1932. Vergil Mulholland, West Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. Original application filed 9/10/23. Divided and this application filed 5/18/28.

MANUFACTURE OF BLOWN GLASSWARE. U. S. 1,840,532. Jan. 12, 1932. George E. Row, West Hartford, Conn., assignor to Hartford-Empire Co. Filed 1/4/29.

MAGNIFYING GLASS FOR RADIO DIALS. U. S. 1,837,638. Dec. 22, 1931. Jacob B. Weintraub, Miami, Fla. Filed 5/28/30.

APPARATUS FOR SEALING LAMINATED GLASS. U. S. 1,841,745. Jan. 19, 1932. Paul C. Lawson, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Ohio. Filed 5/5/28.

SHEET GLASS APPARATUS. U. S. 1,841,714 and 1,841,715. Jan. 19, 1932. Carroll Cone, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 11/30/29.

HEAT ABSORBING MEANS FOR SHEET GLASS APPARATUS. U. S. 1,841,716. Jan. 19, 1932. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Ohio. Filed 1/27/27.

GLASS MELTING FURNACE. U. S. 1,841,717. Jan. 19, 1932. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 6/9/27.

WIDTH MAINTAINING MEANS FOR SHEET GLASS APPARATUS. U. S. 1,841,660. Jan. 19, 1932. Luke C. Mambourg, Lancaster, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 10/30/26.

METHOD AND APPARATUS FOR DRAWING SHEET GLASS. U. S. 1,841,580. Jan. 19, 1932. Frank Frawer and William E. Nobbe, Toledo, O., assignors to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 4/18/30.

METHOD AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,841,576. Jan. 19, 1932. John L. Drake, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Ohio. Filed 3/10/30.

DEVICE FOR ADJUSTING THE THICKNESS OF GLASS PLATES AND SHEETS. U. S. 1,819,222. August 18, 1931. Yvon Brancart, Verreries de Fauquez, Ronquieres, Belgium. Filed 2/14/30 and in Belgium 2/14/29. In combination with a casting table, a calibrating roller, a pair of bearings for said roller, a pair of carriage bodies each carrying one of said bearings, wheels supporting said carriage bodies, said wheels resting on said table, screws interposed between said wheels and said carriage bodies, said screws engaging said bodies, and means for locking said carriage bodies in adjusted position with respect to said screws.

APPARATUS FOR SEALING LAMINATED GLASS. U. S. 1,823,525. Sept. 15, 1931. Frank H. Bell, Ferndale, Mich., assignor to Triplex Safety Glass Company of North America, N. Y. Filed 5/1/28. An apparatus for filling with sealing material the sealing slot at the edge of laminated glass which comprises a pot for the sealing material, a roller support for the glass at one side of the pot, a rotating disc arranged to dip into the sealing material and having a thin edge to enter the sealing slot, the sealing disc having shoulders at the sides of the thin edge to support the glass at the level of the roller support, and means to rotate the disc independently of the movement of the glass.

METHOD OF PRODUCING OPENINGS, PASSAGES, AND THE LIKE IN MOLTEN OR PRESSED GLASS BODIES. U. S. 1,815,146. July 21, 1931. Bernhard Erber, Vienna, Austria. Filed 11/29/27. A method of producing openings, passages, capillaries and the like in molten or pressed glass bodies, comprising fusing into the glass material a composite wire consisting of a metallic core, a metallic coating and a layer of graphite, talc and the like between said core and said coating, said composite wire having about the diameter of the opening to be made and a coefficient of expansion higher than that of the glass, and withdrawing said metallic core after cooling and leaving the free opening in the glass.

LAMINATED GLASS. U. S. 1,821,598. Sept. 1, 1931. George B. Watkins, Toledo, O., assignor to Libbey-Owens-Ford Glass Company, Toledo, O. Filed 7/5/29.

PROCESS OF MANUFACTURING MARBLED AND MULTCOLORED GLASS. U. S. 1,832,491. Nov. 17, 1931. Claude Locreille, Fauquez, Belgium. Filed 3/27/30 and in Belgium 4/3/29.

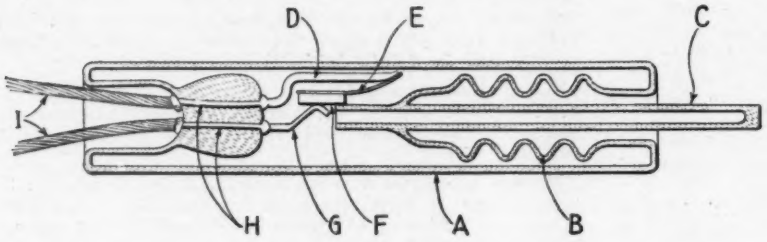
GLASS FEEDER. U. S. 1,832,331. Nov. 17, 1931. Thomas Stenhouse, Washington, Pa., assignor to Hazel-Atlas Glass Company, Wheeling, W. Va. Filed 8/5/26.

GLASS WORKING MACHINERY. U. S. 1,832,039. Nov. 17, 1931. George A. Millar, Ridgefield Park, N. J., assignor to General Electric Vapor Lamp Company, Hoboken, N. J. Filed 9/23/26.

An Electrical Hair-Trigger

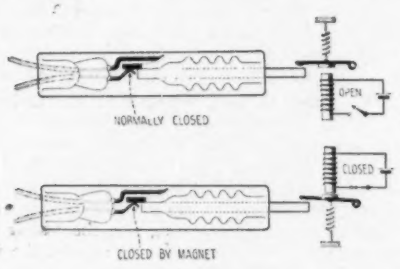
Utilizing the Elastic Property of Glass

UNLEASHING two horsepower of energy when its stem is imperceptibly moved, a vacuum contact now introduced to the electrical and allied industries of America may truly be termed an electrical hair-trigger. In potential applications it may be likened to the vacuum tube amplifier, since it places a small amount of energy in complete control of thousands of times as much energy. Furthermore, it eliminates most of the complicated, cumbersome, costly and frequently troublesome array of apparatus heretofore required for the harnessing of electrical equipment to be controlled by delicate means. Properly applied, especially in conjunction with simplified light-sensitive cells, this device opens up



startling possibilities limited solely by the fertility of ingenious minds. By the slightest mechanical or electromagnetic influence it controls powerful electric currents by means of a novel vacuum contact. All of its possible applications to glass manufacturing and other industries operations have not yet been fully determined.

The Burgess Vacuum contact is a new and improved device for use wherever a positive, rapid and durable electric contact is needed in circuits handling up to 6 amperes continuous load or 8 amperes intermittently, at potentials up to 220 volts. It can be



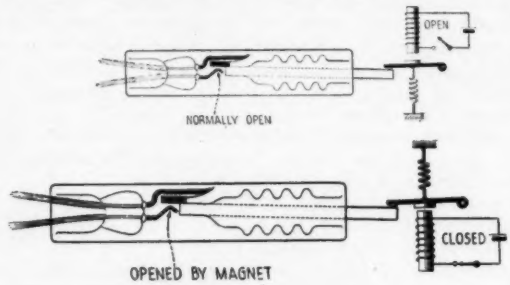
operated by hand, by mechanical means, or again by an electromagnetic agency in conjunction with the usual telephone type relay. This contact is especially well adapted for use with controllers in telegraph and telephone circuits, for railway switches and signals, for fire and burglar alarm systems, advertising signs, rectifiers, electric ranges and other applications where a considerable wattage must be controlled by a minimum of energy.

The accompanying diagram presents the operating details of the vacuum contact. It will be noted that the principle is extremely simple. It makes use of the elastic property of specially annealed glass to cause the mechanical actuation of contacts sealed in vacuum. The bellows *B*, because of their shape and the tempering of the glass, are highly elastic. A slight movement of the steam or protruding rod *C* is communicated to the movable contact block *E* causing it to separate from contact block *G* which is stationary. The spring *E* makes positive contact between the contacts when no pressure is applied to the steam. The contacts are maintained in the evacuated glass tube *A*. The leads are indicated at *I*.

The vacuum contact is a development of Siemens & Halske of Germany and has met with wide application in that country as well as in Great Britain. It is now being introduced in the United States for the first time by the Burgess Battery Company of New York and Chicago.

Operating in a vacuum, the vacuum contact is free from serious arcing and corroded contacts. It can handle its rated current as fast as 40 breaks per second. The make and break are positive and clean, without the hang-overs and chattering experienced with other forms of contacts, as has been proved by comparative oscillograph recordings. The vacuum contact requires a movement of only .02 inch at the end of its stem, which can be brought about by a force of less than 10 ounces, and usually but 6 ounces. The temperature rise at the rated current is extremely slight. The circuit is broken without arcing at less than 0.001 inch separation of the contact blocks. The small movement and slight force required for operation lowers the total cost by the elimination of mechanical links. As for life, one of these contacts has been operated, at a rate of 10 times per second, 124,000,000 times, without breakdown.

This novel vacuum contact is conservatively rated to handle 6 amperes at 220 volts, or 1,320 watts, on continuous load. It will handle 8 amperes intermittently. The energy controlled is therefore of the order of two horsepower, controlled by the slightest pressure on the glass stem. There is no spark or arc, although



on inductive loads a condenser is shunted across the contact. This device represents an ideal means of breaking heavy A. C. or D. C. currents with safety, rapidity and small force.

The normal action of the vacuum contact is with contact blocks in positive contact. A slight pressure on the stem breaks the circuit. However, this action can be reversed by mounting the contact with a pressure on the stem normally to break the circuit. Releasing the pressure will cause the circuit to close. Either method of control is practical. The ideal method of operating the vacuum contact is by means of a single electro-magnet relay or telephone type relay, the armature of which is coupled to the end of the vacuum contact stem. The vacuum contact is clamped to the relay by suitable means.

With the early availability of an entirely new form of light-sensitive cell, the vacuum contact promises to play an important role in the light control of many electrical circuits. The vacuum contact makes possible the operation of powerful equipment by means of light control, with an absolute minimum of equipment. The vacuum contact may be operated by a simple telephone type relay operating in the plate circuit of an amplifying tube fed by the output of the light-sensitive cell circuit, or again by a sensitive polarized relay actuated by the cell and in turn controlling the telephone relay which operates the vacuum contact for controlling over a thousand watts if necessary.

The Glass World and What It Is Doing

News of the Industry

Good-Bye Tin Can and Glass Container!

The Family Meal Comes in an Envelope

"THE early abolition of the tin can and the extension of dehydrating processes by which fresh vegetables and fruits may be sold to housewives in small envelopes containing sufficient to supply their families were predicted last night by Professor C. W. Thomas, formerly of Columbia University, in a lecture before the American Society of Mechanical Engineers in the Engineering Auditorium, 29 West Thirty-ninth Street.

"Professor Thomas said that recent improvements in the spray drying of potato flour and tunnel drying of spinach and other vegetables in Joliet prison, Joliet, Ill., had been productive of results which soon might be applied to other vegetables and fruits. New machinery which would extract 90 per cent of water from most vegetables, so that it could be added again by soaking, has been brought to a stage of commercialization which challenges the canning industry, he said.

"New machines, which dissipate all of the oxygen present in the processes, make possible the hermetical sealing of dried products in the presence of carbon dioxide so that the simple addition of water will revive them to their original state. In addition, the time necessary for treating considerable quantities has been reduced from days to four or five hours.

"The examples set forth by the lecturer to his audience of food engineers of the metropolitan section of the society included spinach and carrots, two vegetables which have defied dehydration and restoration to their original state except in elaborate experimental laboratories. By the use of modern methods both these products can be preserved so that they are reduced to one-tenth their original volume and weight and yet can be watered so that none can detect that they are not fresh from the garden, he said.

"An engineer in the audience said that airplanes could replace long freight trains in supplying cities with food if the processes became universal."—*N. Y. Times* ("Sees New Process Ending Canned Foods.")

Dr. Binns Retires

Dr. Charles F. Binns, who for thirty-one years has directed the New York State School of Clay Working and Ceramics at Alfred University, Alfred, N. Y., announced on December 31 his retirement from that office, brought about because of the New York State retirement laws.

Dr. Binns was born in England and attended the King's Cathedral School at Worcester. After mastering the fundamentals of the manufacture of whiteware he was sent to London to take care of that company's sales. Dr. Binns spent the summer of 1923 at the Chicago World's Fair and had made so many friends during his visit in this country that it had a decided influence in bringing him back several years later as a permanent resident.

When the State School at Alfred was established in 1900, Dr. Binns was selected for director. He has been connected with the American Ceramic Society, of which he was one of the thirty-two charter members, since its organization in 1899. This organization was started by a group of men who were interested in increased technical information about ceramic materials and products. Such information, which had been very scarce and carefully guarded by those manufacturers who had chanced to find it, is now easier to obtain.

Dr. Binns exerted a strong influence in unlocking recipe books and solving manufacturing problems by bringing them out of their hiding places into the light of discussion. He has been vice-president, president and secretary of the Society and in connection with his Society work has published many technical reports and pamphlets of valuable information.

Dr. Binns has as well written several books, including "The Story of a Potter" and "The Pottery Craft." He has served the Metropolitan Museum of New York in many ways, being recognized as an authority on interpretation and value of historic ceramics.

In addition to his other accomplishments he has the skill of perfect manipulation of the pottery wheel. In 1925 the University distinguished itself and took an unprecedented stand when it granted an Honorary Degree to a member of the faculty, Dr. Binns.

The alumni of the school announced that an annual award had been established to be known as the Binns medal for excellence in ceramic art.

Even though officially retired from his duties, Dr. Binns will continue to be interested in the school and will give freely of the knowledge and experience gained through his many years of service.

Bureau of the Census Questionnaires Being Mailed

The 1931 questionnaire of the Bureau of the Census has been considerably simplified over that of 1929. The Bureau is seeking the cooperation of manufacturers to return their reports promptly. The value of the statistics is dependent largely upon their timeliness. The manufacturers can aid the Bureau materially by taking care to answer all inquiries completely and correctly and return their reports promptly. Information given on the questionnaires should relate preferably to the calendar year 1931, but if more convenient it can cover a business or fiscal year within the period from April 1, 1931, to March 31, 1932. In either case it must cover a year's operations, unless the plant was recently organized or went out of business during the year. The major items covered this year are wage earners employed, by months, wages paid, cost of materials, fuel and purchased electric energy, products by quantity and value.

Two Well-Known Glass Publications Merge

Announcement was made in January of the merger of the *Crockery and Glass Journal*, which for fifty-eight years has been a highly respected and consistent worker for the best interests of the glass industry, and *China and Glass Guide*, the latter of which moved from Chicago to New York only recently. Statements disclosing the reasons for this development have been issued by F. Calvin Demarest, who has been at the head of the *Crockery and Glass Journal* for many years and was responsible for its notable success, and *China and Glass Guide*, published by the Haire Publishing Company, New York. The latter company publishes half a dozen or more merchandising publications, several of which also have a long history of continuous service to the trade.

This move towards efficiency and still better service to the trade will doubtless be welcomed by the distributing branches of the glass and pottery industries.

Northwest Glass Plant Strides Forward.

Glass production of artistic, industrial, and general utility nature has been mounting steadily higher at the Seattle glass plant of the W. P. Fuller Company, as distribution has been steadily extended over a wide Western territory.

Now one of the largest contracts ever placed in the Northwest has been given to this company which will furnish the diversified glass needs of the new three million dollar Ford plant being erected in Seattle Wash. This three million dollar factory for the new Ford cars in the Northwest city has been the means of furnishing the Fuller company with its largest glass contract, and possibly the largest ever placed in this section. It will help in a large way the employment situation in the section.

In this important award for the windows for workers in the new Ford plant that will be located along the shore of the picturesque Duwamish River in the southern industrial section of Seattle, there is comprised six thousand square feet of polished plate glass; forty-five thousand square feet of rough wire glass; 1,800 square feet polished wire glass; 60,000 square feet of sheet glass, and 1,000 feet of 3/16 Syenite. Thus a "day-light" plant is assured the large force of Ford workers, through the glass and glazing that is to be accomplished by the Fuller organization in Seattle.

This new industrial contract received by the W. P. Fuller Company exemplifies the versatile production facilities of a plant whose stained art glass has been used in all types of modern buildings. The artistic originality of the colorful panes have found widespread usage in mausoleums, modern moving picture palaces, cathedrals, and public buildings for various purposes.

Extensions at Sand Springs Plant

The No. 1 furnace of the Kerr Glass Company at Sand Springs, Okla., completely rebuilt after the newest designs, and with a new packing and storage building, will be ready for operation early this year, it has been announced at the plant.

Furnace No. 2, after having been shut down for seasonal repairs, has been cleaned out and lighted again. Labor employed in the production of jelly glasses and fruit jars, in view of the seasonal character of these products, is being staggered wherever possible to allow employment for all plant employees.

The new furnace is built after a pattern developed exclusively by the Company, which holds the patents on it. It includes a furnace raised above the level of the old one, allowing for more efficient operation of the automatic receivers. It is represented as the latest thing in glass manufacture, and will further establish the company as one of the largest glass concerns in that section of the nation. The Kerr Glass Company is already acknowledged the second largest manufacturer of glass fruit jars in the United States.

Company officials state that during the past year the plant has had one of the most successful seasons since it was established, and advise that the factory will go back into operation with full force again soon after January first.

New Bin Gate with Remote Control

A new automatic dump gate that can be opened and closed by electric push release switch has been developed by the Stephens-Adamson Mfg. Co. of Aurora, Ill. The gate was designed primarily for emptying batch weigh hoppers in ready mixed concrete plants, but can be used wherever the entire load in a bin or hopper is to be dumped by remote control. This new gate is made for openings from 12 in. x 12 in. to 18 in. x 24 in. and can be operated by push release switch from a control panel at any distance from the hopper.

The Department of Commerce has issued a statement to the effect that many letters are being mailed to Canada bearing only two cents postage, on which the recipient must pay an additional one cent and one cent penalty. The special delivery rate to Canada is twenty cents.

Division of Simplified Practice, Bureau of Standards, recently mailed the simplified practice recommendation covering dental mouth mirrors to all interested for their consideration and written approval. The program establishes four stock diameters of plain and magnifying cone socket mirrors.

Distribution of Fuel Oil Decreased During 1930

Deliveries of gas oil and fuel oil during 1930, as reported to the United States Bureau of Mines, Department of Commerce, by oil refining and marketing companies, totalled 385,080,162 barrels, including exports and shipments to non-contiguous territories, as compared with 411,149,930 barrels in 1929; 297,660,095 barrels in 1928; 381,662,801 barrels in 1927; and 372,650,767 barrels in 1926. A decrease of 23,368,820 barrels, or 6.28 per cent, was reported in deliveries within the United States, while shipments to foreign countries and non-contiguous territories decreased 2,700,948 barrels, or 6.90 per cent. The net result is a total decrease in domestic and foreign deliveries of 26,069,768 barrels, or 6.34 per cent. This decrease is the first recorded during the five years covered by this series of fuel oil surveys.

Construction Expectations

Construction expectations for the first quarter of 1932 are summed up by F. W. Dodge Corporation in the current *General Building Contractor*. These strikingly point to the fact that, although this balance wheel of American industry turns more slowly, it is still turning, not standing still, and at a pace which approximates pre-boom conditions. A total of $850,000,000 as a maximum construction volume for the last quarter is not, Mr. Schnitman shows, of the gargantuan proportions to which the American industrial appetite has been whetted during its orgies of the past decade; yet it does represent a huge expenditure, with large significance to labor and materials.

Didymium Glass Goggles for Glass Blowers

The Burgess-Parr Co., Inc., 202 E. 44th Street, New York, have introduced new goggles to assure maximum protection and comfort to glass blowers on precision work. These goggles involve the use of a special didymium glass which possesses the unique characteristic of transmitting all light except the objectionable yellow glare from incandescent glass. The pinkish lenses are mounted in a recently designed bakelite frame. The lenses are adequately protected against accident or breakage.

Plate Glass Production Down Again

From figures compiled by P. A. Hughes, secretary of Plate Glass Manufacturers Association the production of polished plate glass in the United States for the month of November, 1931, was 3,384,882 sq. ft., as compared with 4,531,507 sq. ft. produced in the preceding month, October 1931.

Adding a Sand Blast Plant

R. J. Natlis, Dubuque, Iowa, manager of the Nurre Mirror Plate Company, Burlington, Iowa, has announced that sand blasting equipment is being installed at the plant for etching work and that in 1932 the firm will add window glass, rough glass and crystal glass to its lines.

Census of Clocks, Watches and Parts

A recently issued report on clocks, watches and parts of the 15th U. S. census in this field included clock movements, time recording devices and time stamps. The total number of establishments engaged in the manufacture of these products in 1929 was 56, an increase of 4 over the 1927 census. The total production value amounted to $42,165,875. Material and containers used were valued at over $10,000,000. The value of watch crystals and glass clock faces used is not segregated in this report.

The United States Tariff Commission on January 8 announced that the public hearing heretofore set in their investigation No. 53 on non-edible gelatin and glue, and postponed at the request of parties interested, is now set for February 15, 1932.

New Frosting and Etching Compounds

The Sterling Products Company, Easton, Pa., manufacturing chemists, have announced two new forms of frosting and etching compounds for the glass industry.

Decreased Duty on Cylinder, Crown and Sheet Glass

Commerce Reports of December 14, 1931, publishes the President's proclamation decreasing rates of duty on cylinder, crown and sheet glass. The principal reason given for the decreases is that the President found that the rates of duty on Belgian glass were not such as to equalize the differences in the cost of production between the two countries. The particulars of the reductions on cylinder, crown and sheet glass are given below:

Decreases in the rates of duty expressly fixed in paragraph 219 of Title I of said act on cylinder, crown, and sheet glass, by whatever process made, and for whatever purpose used, not exceeding 150 square inches, from 1⅞ cents per pound to 1 26/64 cents per pound; above that, and not exceeding 384 square inches, from 2 1/16 cents per pound to 1 35/64 cents per pound; above that, and not exceeding 720 square inches, from 2 7/16 cents per pound to 1 53/64 cents per pound; above that, and not exceeding 864 square inches, from 2⅝ cents per pound to 1 62/64 cents per pound; above that, and not exceeding 1,200 square inches, from 3 cents per pound to 2¼ cents per pound; above that, and not exceeding 2,400 square inches, from 3⅜ cents per pound to 2 34/64 cents per pound; above that, from 3¾ cents per pound to 2 52/64 cents per pound.

And a decrease in the minimum rate of duty expressly fixed in paragraph 219 of Title I of said act on cylinder, crown and sheet glass, by whatever process made, and for whatever purpose used, weighing less than 16 ounces but not less than 12 ounces per square foot, from 50 per cent ad valorem to 37½ per cent ad valorem.

Decreasing the Rate of Duty on Feldspar

The proclamation of the President decreasing the rate of duty on feldspar imported into the United States is published in Commerce Reports of December 14. The reason given for making the decrease is that duties on feldspar imported from Canada, the principal competing country, were found not to be equal the difference in cost of production between the two countries. The effect of this proclamation is to reduce the duty on imported crude feldspar from $1.00 per ton to $0.50 per ton.

REMOVAL NOTICE

PLEASE note that beginning February 1, 1932, the offices of J. VAURIE, Agent of the Saint-Gobain Co. and its affiliated interests, will be removed from One Madison Avenue, New York, to:

Suite 3130-32
500 Fifth Avenue, New York, N. Y.
(N.W. Corner of 42nd St.)

New Telephones: CHickering 4— { 5024 / 5025

Recent Deaths

W. B. Chapman

W. B. Chapman, former president of The Chapman Engineering Company of Mt. Vernon, Ohio, died on December 16 in Chicago, following an emergency operation for appendicitis. Mr. Chapman was inventor of the gas producer bearing his name, which was formerly built by The Chapman Engineering Company, but is now made by The Cooper-Bessemer Corporation of Mt. Vernon, Ohio.

Inquiries Received

For further information address THE GLASS INDUSTRY.

565. Who makes "one-way vision" glass in the United States.
566. Please put us in touch with the owner of some idle glass factory which could be adapted to the manufacture of opal jars.

What the World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C. For further information write the department.

Bolivia—55168. Glass, for manufacturing mirrors, window glass, medium sized beer glasses, and beveled mirrors.

Canada—55191. Glassware, restaurant.

Cuba—55427. Glassware and chinaware, for household, hotels, cafes, and domestic service.

Germany—55505. Glass (cut) products.

Dominican Republic—55562. Glassware.

Canada—55813. Spectacle frames and lenses, both ground and unground; and opera and field glasses.

Venezuela—55769. Glass articles.

Readers Wants and Offers

Address answers to all "keyed" ads c/o The GLASS INDUSTRY 24 West 40th St., New York

SITUATION

Large English Glassworks wants a Manager with expert technical knowledge of Glass Bottle trade. An interest might be given to experienced capable man who could control. Reply to Dorland, 205 East 42nd Street, New York.

MOULD MAKERS

Wanted experienced men used either to pressed or blown moulds for glass trade. Good wages paid and living quarters found. Address Chance Brothers and Co., Limited, Glass Works, Smethwick, England.

U. S. REPRESENTATIVE WANTED

Renowned Czechoslovakian glassworks seeks capable representatives for the United States. Specialties-stemware, cut and plain cheap vases for chain stores, as well as better and best grades of glassware. Address Wilhelm Kralik Sohn, Eleonorenhain, Czecho-Slovakia.

GLASS CONSULTANTS

THE SHARP-SCHURTZ COMPANY
CHEMISTS AND CONSULTING ENGINEERS
FOR THE GLASS INDUSTRY
LANCASTER, OHIO U. S. A.

BAILEY & SHARP CO.
INCORPORATED
CONSULTING ENGINEERS
GLASS TECHNOLOGISTS
CABLE ADDRESS "SHARPGLASS"
HAMBURG, N. Y. U. S. A.

Current Prices of Glass-Making Materials

January 22, 1932

Quotations furnished by various producers, manufacturers and dealers.

Acid	Carlots	Less Carlots
Citric (dom.) ..... lb.	..	.33½
Hydrochloric (HCl) 20° tanks, per 100 lt	..	1.10
Hydrofluoric (HF) 60% (lead carboy) .. lb	..	.13½
52% and 48% ..... lb.	10	.10-.11½
Nitric (HNO_3) 35° carboy ext. Per 100 lb.	5.50	..
Sulphuric (H_2SO_4) 66° tank cars ..... ton	15.50	..
Tartaric ..... lb.	..	.25½
Alconol, denatured ..... gal.	..	..
Aluminum hydrate (Al $(OH)_3$) ..... lb	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3) ..... lb	..	.07
Ammonium bifluoride (NH_4) FHF ..... lb.	..	.15½
Ammonia water (NH_4OH) 26° drums .... lb.		
Antimony, metallic (Sb) ..... lb.	.02½	.02¾
Antimony oxide (Sb_2O_3) ..... lb.	..	.09¾
Antimony sulphide (Sb_2S_3) ..... lb.	..	.08½
Arsenic trioxide (As_2O_3) (dense white), 99% ..... lb.	.04	.04½
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh ton	47.00	..
90% through 100 mesh ..... ton	44.00	..
Barium hydrate ($Ba(OH)_2$) ..... lb.	..	.05¼
Barium mixture, glassmaker's, f.o.b. St. Louis ..... ton	25.00	..
Barium nitrate ($Ba(NO_3)_2$) ..... lb.	..	.07¼
Barium selenite ($BaSeO_3$) ..... lb.	..	..
Barium sulphate, in bags ..... ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point, ... ton	15.00-16.00	18.00
Bone ash ..... carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$) ..... lb.	..	.0355-.0425
Crystal ..... lb.	.028-.033	..
Granulated ..... lb.	.025-.03	..
Powdered ..... lb.	.02875-.03375	..
Boric acid (H_3BO_3) ..... lb.	.0625-.07125	.0625-.08125
Refined ..... lb.	.0625-.07125	.07125-.08125
Cadmium sulphide (CdS)—		
Red ..... lb	..	.65- 90
Orange ..... lb.	..	.60-1.10
Yellow ..... lb	..	1.30-1.50
Chromium oxide (Cr_2O_3) ..... lb	..	.20
Cobalt oxide (Co_2O_3)		
In bbls. ..... lb	..	1.35-1.45
In 10 lb. tins ..... lb	..	1.45
Copper oxide		
Red (Cu_2O) ..... lb.	..	.25
Black (CuO) ..... lb	..	.17-.19
Black prepared ..... lb	..	.22
Cryolite ($Na_3Al F_6$) Natural Greenland		
Kryolith) ..... lb.	.09	.09¼
Synthetic (Artificial) ..... lb.		.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb	..	1.15-1.20
*Feldspar—		
100 mesh ..... ton	11.50-17.50	12.00-18.00
80 mesh ..... ton	11.00-11.50	13.00
40 mesh ..... ton	10.75-11.00	12.00
20 mesh ..... ton	9.50- 9.75	10.00
Fluorspar (CaF_2) domestic, ground, 96-98% (max SiO_2, 2½%)		
Bulk, carloads, f.o.b. mines ..... ton	30.00	..
In bags or barrels ..... ton	34.00	39.00
Imported ..... ton	30.00-31.00	33.00-37.00
Formaldehyde ..... lb.	..	.07
Graphite (C) ..... lb	..	.04-.07
Iron oxide—		
Red (Fe_2O_3) ..... lb	..	.0425
Black (FeO) ..... lb	.04½	..
Kaolin (f.o.b. mine) ..... ton	8.00-9.00	..
English, lump, f.o.b. New York ..... ton	14.50-25.00	24.50-30.00

*Spot Shipments.

Cryolith (see Cryolite)	Carlots	Less Carlots
Lead chromate ($PbCrO_4$) ..... lb	..	.30
Lead oxide (Pb_3O_4) (red lead) ..... lb.	.0625	.0675
Litharge (PbO) ..... lb.	.0525	.0575
Lime—		
Hydrated ($Ca(OH)_2$) (in paper sacks) ..... ton	5.50	..
Burnt (CaO) ground, in bulk ..... ton	5.00	..
Burnt, ground, in paper sacks ..... ton	7.00	..
Burnt, ground, in 280 lb. bbls. .Per bbl	2.15	..
Limestone ($CaCO_3$)	1.50-2.50	..
Magnesia (MgO)—		
Calcined, heavy (in bbls.) ..... lb	.06	.07
light (in bbls.) ..... lb	..	.23
extra light (in bbls.) ..... lb.	..	.37
Magnesium carbonate ($MgCO_3$) ..... lb.	.06	.10
Manganese 85% (MnO_2) ..... lb.	.03	.03
Nickel oxide (Ni_2O_3), black—		
for nickel content ..... lb	..	.35
Nickel monoxide (NiO), green—		
for nickel content ..... lb	..	.35
Plaster of Paris, bags ..... ton	21.00	23.00-29.00
Potassium bichromate ($K_2Cr_2O_7$)—		
Crystals ..... lb	.09	.09¼
Ground ..... lb	11	.12
Potassium carbonate—94-96% ..... lb.	.0555	.0555
Calcined (K_2CO_3) 96-98% ..... lb.	.06¼	.07
Hydrated 80-85% ..... lb.	.05¾	.06¼
Potassium chromate (K_2CrO_4) ..... lb.	..	.25
Potassium hydrate (KOH) (caustic potash) ..... lb	.07⅛	.08
Potassium nitrate (KNO_3) (gran.) ..... lb	..	.06-.06¼
Potassium permanganate ($KMnO_4$) ..... lb.	.16	.17
Powdered blue ..... lb.	..	.17½-.18
Rochelle salts, bbls. ..... lb.	..	.16
Rouge ..... lb.	..	..
Rutile (TiO_2) powdered, 95% ..... lb	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4) ..... ton	22.00	..
Selenium (Se) ..... lb	..	1.80
Silver nitrate (AgNO.) ..... (100 oz.) per oz	..	.23¾
Soda ash (Na_2CO_3) dense, 58%—		
Bulk, on contract ..... Flat per 100 lb.	1.05	..
In barrels ..... Per 100 lb.	1.38	1.90-2.13
In bags ..... Per 100 lb.	1.17½	1.72½-1.92½
Spot orders .. .025 per 100 lbs. higher		
Sodium bichromate ($Na_2Cr_2O_7$) ..... lb	.07	.07⅛
Sodium hydrate (NaOH) (caustic soda) Solid ..... Per 100 lb.	2.50	..
Sodium nitrate ($NaNO_3$)—		
Refined (gran.) in bbls. ..... lb.	..	..
95 per cent. ..... Per 100 lb.	1.67-177	1.72-1.82
Sodium selenite (Na_2SeO_3) ..... lb	..	2.00
Sodium fluosilicate (Na_2SiF_6) ..... lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange ..... lb.	..	1.50-1.55
Sulphur (S)—		
Flowers, in bbls. ..... Per 100 lb	3.45	3.80-4.00
Flowers, in bags ..... Per 100 lb	3.10	3.45-3.65
Flour, heavy in bbls. ..... Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals) ..... lb.	.37½	.39
Tin oxide (SnO_2) in bbls. ..... lb	.28	.29½
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black ..... lb	..	2.75
Yellow ..... lb	..	1.50
Zinc oxide (ZnO) ..... lb	.08½	.12
American process, Bags ..... lb	.06½	.07
Zircon		
Granular (Milled .005-.02c higher)	.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)	.03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to December 23, 1931.

	November 1930 Quantity	November 1930 Value	November 1931 Quantity	November 1931 Value	Eleven Months Ending November 1930 Quantity	Eleven Months Ending November 1930 Value	Eleven Months Ending November 1931 Quantity	Eleven Months Ending November 1931 Value
Glass and glass products (Total)	.....	$701,611	.....	$494,569	.....	$8,523,369	.....	$6,469,771
Plate and window glass—								
Window glass, common, box 50 sq. ft.	435	2.002	285	1.635	14.782	80.260	7,544	36,556
Plate glass, unsilvered, sq. ft.	300.752	92.617	264.141	86.746	3.168.949	984.033	3,425,625	1,044,826
Other window and plate glass ..... lbs.	232,479	24.170	127.458	15.386	4.855,675	417.909	2,615,722	268,595
Glass containers (bottles, vials and jars)	.....	193.926	.....	164.256	.....	2.783.972	.....	1,976,912
Table glassware, plain	.....	109.282	.....	71.567	.....	1,125,883	.....	835,697
Table and other glassware, cut or engraved	.....	8.829	.....	8.655	.....	89.223	.....	77,078
Lamp chimneys and lantern globes ..... lbs.	.....	16.923	.....	2.302	.....	207.609	.....	77,404
Globes and shades for lighting fixtures ..... lbs.	.....	39.645	.....	31.845	.....	541.349	.....	382,791
Chemical glassware ..... lbs.	20,473	15.871	15.064	10.321	248,489	214,335	145,988	138,479
Electrical glassware, except for lighting ..... lbs.	83.226	7.908	80.399	4.210	3.380.738	232.832	1.230.070	80,015
Other glassware	.....	190.438	.....	97.646	.....	1.845,964	.....	1,551,418

IMPORTS

Corrected to December 23, 1931.

Glass and glass products	.....	$622.032	.....	$467.872	.....	$8.269.286	.....	$5,973,851
Cylinder, crown, and sheet—								
Plain ..... dut. lb.	434,860	15.581	416.286	16.072	14,003.236	547.474	7,383.254	280.675
Bent, beveled, colored, etc. ..... dut. lb.	231.466	23.445	124.999	19.942	.....	325.175	1,660.586	235,763
Plate glass ..... dut. sq. ft.	487,165	103.493	317.729	56.153	5.222.938	1.111.224	4.470.486	1.047.486
Glass mirrors	8	14	132	401	[2]409	[2]900	1.863	4.694
Rolled, cylinder, crown, and sheet glass, ground, obscured, bent, beveled, colored, etc.	.....	3.340	.....	13.246	.....	[2]22.089	.....	93.362
Laminated glass and manufactures, and plated glass ..	.....	213	.....	188	.....	[2]12.553	.....	17.324
Bottles, vials, jars, and other containers	.....	75.842	.....	55.444	.....	1.069.442	.....	504,498
Scientific articles and utensils ..... dut.	.....	29.103	.....	21.850	.....	477.565	.....	366.001
Tubes and rods ..... dut.	.....	12.795	.....	8.763	.....	[2]44.340	.....	117.179
Illuminating articles ..... dut.	.....	45.847	.....	24.989	.....	557.516	.....	338,921
Blown glass articles—								
Bulbs for electric lamps, without filament ..... dut.	.....	.....	1.010.451	8.076	.....	.....	11,818.173	107,404
Other blown glass articles ..... dut.	.....	.....	.....	41.916	.....	.....	.....	1.888,298
Pressed glass articles	.....	14.651	.....	14.424	.....	193.206	.....	118.200
Other glassware	.....	86.253	.....	86.408	.....	1.020.828	.....	854.046

[2]Beginning June 18, 1930.